JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania,

AND

MECHANICS' REGISTER.

DEVOTED TO

Mechanical and Physical Science,

CIVIL ENGINEERING, THE ARTS AND MANUFACTURES,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

NOVEMBER, 1836.

Practical and Theoretical Mechanics.

Report of the Committee of the Franklin Institute of the State of Pennsylvania for the promotion of the Mechanic Arts, on the Explosions of Steam Boilers. PART II., *containing the* GENERAL REPORT *of the Committee.*

(CONTINUED FROM p. 132.)

27. *First. Unduly heated metal may result from a deficiency of water within a boiler.* This seems to be a frequent and generally acknowledged source of explosion. The forcing-pump, by which a boiler is supplied with water, if at first well regulated, so as to furnish an adequate supply, and if kept constantly in action by the machinery, is subsequently liable to derangement of various kinds. The valves may be put out of order, the passages to or from the pump may be choked by sedimentary, or saline, matter. The pump may in some cases be heated so as to inject steam and not water. Any accident of this sort will cut off the due supply of water, and the level of that within the boiler will be lowered more or less rapidly. This will be true of self-acting, as well as of ordinary, means of supplying boilers. No one we believe has yet been applied, the working of which can, at all times, be relied on. There are, besides, cases in which the forcing-pump is not in action, when the production and use, or waste, of steam is going forward. In some stationary engines, the feeding of the boiler only goes on at inter-

vals, and the due supply is therefore dependant on the attention of the fireman. The same is true of steamboat boilers when the boat stops at a landing, and indeed the mischief is frequently increased by opening the safety-valve by hand, and allowing the steam, and of course the water, to waste freely. By an approximate calculation* it may be seen that to lower the water one inch in a cylindrical boiler with an interior furnace, or in a boiler of the same form where the fire is applied directly to the exterior, and with an interior flue, will require but from five to nine minutes. If by this depression an interior flue of eighteen inches should be laid bare for an inch in depth, between 102 and 103 square inches of surface would be subjected to the action of the fire, for every foot in length of the flue, supposed level.

28. It thus appears that by accident, or in the ordinary management of the steam engine, a deficiency of water may occur, and highly heated metal be produced within a boiler. Recorded instances show that such has frequently been the case.†

29. The metal, then, being softened by heat, may give way to the ordinary working pressure of the steam. This will, of course, depend upon the amount of this pressure, and upon the temperature which the metal has reached. The frequent rupture of boilers near the usual water-line, and in a horizontal plane containing very various thicknesses of metal, would lead us to suspect that this is connected with undue heating, which if all circumstances were equal in the parts of a boiler, would take effect equally, at equal distances from the water-line. But the Committee have not before them any well established instance in which a boiler without interior flues has exploded merely by the ordinary pressure of the steam, when the boiler had been unduly heated. The case of the explosion of a cylindrical boiler, at the foundry of Mr. McQueen, in New York, may have been an exception to this remark, but the fact of the water having been very low, though rendered probable, is not entirely made out.‡ The

* In the case of a cylindrical boiler with an interior furnace and flue, calling l the length of fire-surface, d the diameter of the furnace, and π the ratio of the circumference of a circle to its diameter, $\pi\, l\, d$ = the extent of fire-surface. Then since in a boiler of this kind 1 sq. foot (144 sq. inches) of fire-surface can convert into steam .356 cub. inches of water, per second; $\pi\, l\, d \times \cdot\frac{356}{144}$ = the number of cubic inches of water vaporized per second. Again if we denote by x, the depression in the water level in one second, c the breadth of the water-line, and assume the length of the boiler to be equal to that of the interior cylinder, $x\, c\, l$ will be an approximate value for the quantity of water vaporized. Equating the two values found, and cancelling l, we have $\pi\, d \times \cdot\frac{356}{144} = x\, c$. The depth of water may be assumed at two-thirds the diameter of the exterior cylinder, which, calling D that diameter, gives $c = .98$ D, and $\pi\, d \times \cdot\frac{356}{144} = .98\, x$ D. The ratio of d to D in a number of cases in practice varies from .4 to .6 and even .7; taking the lower limit or $d = .4$ D, we have $.4\, \pi$ D $\times \cdot\frac{356}{144} = .98\, x$ D. Whence $x = .003$ inches per second. Or to lower the level one inch would require 5 mins. 16 secs., supposing the water not to reach the interior flue.

For a cylinder with an interior flue, but where the fire is applied, externally, supposing the effective fire-surface to be half that of the boiler, the depression per second, will not be less than two-thousanths of an inch.

† As instances, may be taken, the boiler of the steamboat Huntress, No. VII. Replies, &c. of the Western Engineer, No. II, Replies, &c. Legislator, Eagle, and Massachusetts, No. XVII. Replies, &c. Explosions at Pittsburg, No. XII. Replies, &c. and Jour. Frank. Inst. vol. iii. p. 70.

‡ Thomas Ewbank "On the Explosion of Steam Boilers," Jour. Frank. Inst. vol. x. p. 3. That the pressure was unusually great, is satisfactorily shown; and with or without undue heating, was, no doubt, the cause of the explosion. In the case of the Etna,

copper boiler exploded in the experiments of the Committee, may be considered, however, as illustrating the possibility of such an occurrence.* The explosions in boilers with interior flues, arising from these circumstances, have been found to affect those flues which "collapse," that is, are crushed, and rent, and are frequently separated from the boiler. The case of the accident on board the steamboat Patriot, which occurred near the mouth of the river Ohio, in 1828, distinctly illustrates this point.† It is stated that the engine was kept in motion after it was known that the water was below the flues; an act of temerity which was followed by the collapse of one of the flues.

30. It is highly probable, as will be seen hereafter, that water is thrown upon the hot metal, in cases where the engine has just been set in motion, or when the safety-valve has been opened, just prior to an explosion, and hence we are not warranted in adducing such cases here.

31. The following, is a well authenticated instance in which the pressure was not sufficient to produce explosion, or in which the metal was cooled by its change of figure, but when the danger was obviously imminent. It was that of the boiler of the steamboat Legislator,‡ of which an oval flue was flattened by exposure to the steam pressure, when known to be unduly heated. An explosion was avoided by the fire being put out, as soon as the deficiency of water was ascertained.

32. The Committee next proceed to consider the means which have been pointed out, by which, in the event of an undue heating of a boiler, water may obtain access to the heated metal.

Various means by which water may be brought into contact with heated metal, have been suggested. This may occur by the intentional or accidental removal of an obstruction, or by some other repair, to a forcing-pump,§ or by the injection of water by a hand-pump.‖ When it is recollected that one cubic inch of water will produce six hundred and twenty-one cubic inches of steam of three atmospheres, or one hundred and eighty-nine inches of steam of eleven atmospheres, and that this steam is produced far more rapidly than in the usual action of the boiler, we are at no loss to understand that an ordinary safety-valve cannot give vent to it. The explosions on board of the steamboats Grampus, Constitution, &c., should serve as warnings against the introduction of water into a boiler under such circumstances, and the course taken by the engineer of the Legislator as an example to be followed. In this latter case there can be no doubt, from the circumstances stated by Mr. Lester,¶ that an explosion

the boiler was unduly heated, but, whether it gave way to the pressure, ascertained from the working of the engine, to be lower than usual, or whether water had access to the hot metal, is not known.

* Report of the Committee on Explosions, Part I. p. 68. Jour. Frank. Inst. vol. xvii. p. 225.

† Replies to Circular, &c. No. XXI. Thomas J. Haldermann, Esq. The explosion on board the Tricolour might be cited as another example. The boat was at rest. No. XXI. Replies, &c.

‡ Replies to Circular, No. XVII. E. A. Lester, Esq. of Boston.

§ In the case of the boilers of the Car of Commerce, (No. VII. Replies, &c.) of the Grampus, (No. XII. Replies, &c.,) &c.

‖ See explosion of a boiler at Aston Forge, (No. XI. of Replies, &c.). Boiler of the steamboat Constitution, (No. VIII. of Replies, &c.,) &c.

¶ See Replies to Circular of Com. on Explosions, No. XVII. Letter of E. A. Lester Esq., to Sec. of Treasury.

was prevented by cooling the boilers previous to the introduction of water, when the deficiency was discovered. No circumstance of mere convenience, should be suffered to interfere with such a course.

33. A second means assigned for bringing water in contact with unduly heated metal in a boiler, is by the foaming produced by the opening of a safety-valve, or in the ordinary working of the engine. This foaming has been abundantly demonstrated, and a detailed statement of the direct experiments made on the subject by this Committee, may be seen in their report to the Secretary of the Treasury of the United States.* Since the foaming is caused by making an opening in the boiler, it may be supposed that it cannot be adequate to do more than to produce steam to supply the place of that which escapes. This view of the subject derives some support from the experiments incidentally made by M. Arago,† and directly with this object by the Committee, but is contradicted by those of M. M. Tabareau and Rey.‡ In the experiments of M. Arago, the boilers were not unduly heated; in those of the Committee, there was present a considerable amount of heated metal, and in those last referred to, and in which an increase in the elasticity of the steam was produced by opening a safety-valve upon a small boiler, the boiler was surrounded by a charcoal fire. There can be little doubt, then, that the result must depend upon the precise circumstances of the case, and that danger *may* result, though it does not *necessarily* follow, from making an opening in the boiler when the water is low. This effect from foaming would be increased, if in addition to the agitation produced by the first working of the engine, after stopping, the safety-valve should be opened. This was the common practice on the Hudson, a few years since; the safety-valve being opened, by hand, on putting the boat in motion after the landing or taking up of passengers.

34. The successive explosions of connected boilers such as occurred at the Polgooth§ mines, and on board the steamboat Rhone,‖ are easily explained if referred to the effect of foaming, and difficult to understand on any other principle, since just before the explosion of the second boiler a large opening was made for the escape of steam.¶

35. It has been assumed by our countryman Perkins, in his hypothesis on the subject of the explosion of steam boilers, that the hot steam formed by contact with unduly heated metal is the true source of danger. This opinion has been shown to be inconsistent with the deductions from sound theory.** The injection of water into hot and unsaturated steam, should

* Reply to query first. "To ascertain, by direct experiment, whether on relieving water heated to, or above, the boiling point, from pressure, any commotion is produced in the fluid." See also a paper by Mr. F. Peale, whose observations were contemporaneous with experiments of the Com. Jour. Frank. Inst., vol. viii. p. 145, and Replies, &c. No. XXI. Potts on Explosions, Jour. Frank. Inst., vol. vi. p. 327.

† M. Arago. Sur les explosions, &c. Annuaire du Bureau des Long., 1830, pp. 148, and 180, and Jour. Frank. Inst., vol. v. p. 404, and vol. vi. p. 47.

‡ Ibid.

§ J. Taylor, Esq. "On the accidents incident to Steam Boilers." Lond. Philos. Mag. vol. i., 1827.

‖ Annuaire du Bureau des Long., 1830, and Jour. Frank. vol. v. p. 401.

¶ The same opinion is expressed by M. Arago, Annuaire, &c. p. 184. Translated in Jour. Frank. Inst., vol. vi., p. 49. The other cases referred to by him, in which an explosion followed the opening of a stop-cock by hand, as at Lyons, or of a safety-valve by the steam, as at Essone, may be explained by supposing the openings insufficient to give vent to the steam, which was produced by the action of the boiler, in the circumstances then existing.

** Dulong. Annales de Chim. et de Phys. vol. xlviii.

reduce, not increase, its elasticity. With a view to ascertain if any circumstances had been omitted in the application of theory to this problem, the Committee made direct experiments on the subject. The water was introduced both in a full stream, and through small apertures. In no case, an increase, and in all but one a perceptible decrease, of elasticity in the hot and unsaturated steam, was observed. Fourteen ounces of water, injected into steam at 533° reduced its pressure .34 of an atmosphere.* The steam had in this experiment a temperature corresponding to the pressure of sixty atmospheres,† and an actual elasticity of only 6.82 atmospheres. There was besides a fire which supplied heat, as it was absorbed by the vaporization of the injected water.

36. A correspondent has suggested‡ that when a steamboat is first set in motion, the inertia of the water may cause it to rise at one end of the boiler and then to oscillate, by which it would be thrown upon parts of the boiler which might be unduly heated. This is no doubt a true cause, but it would be difficult to say to what extent it would be effective. The subsequent suggestion that water can take a charge of heat in a latent state, which may be rendered free by mechanical means, the Committee do not conceive to be valid. Experiments which have been referred to as showing this, are fully explicable upon well established principles.

37. There are two other important circumstances to be examined falling under this division of the subject, namely, the effect of the careening of a boat, especially one having connected boilers, and the effects of the sudden cracking of deposits of mud or sediment, beneath which the metal is unduly heated. These will, however, be treated under separate heads.

38. The Committee now proceed to examine *the means proposed for preventing the occurrence of the dangerous circumstances now under discussion.* These of course have reference, mainly, to the original source of the danger, that is to the deficiency of water within the boiler, though an avoidance of the secondary causes might prove effectual.

39. First.—Various self-regulating apparatus for the supply of boilers have been proposed and partially used. Second.—Methods for ascertaining the level of the water or of giving notice when it falls to a certain level, are in use, or have been suggested. Third.—Some methods for ascertaining the temperature of the boiler, or of particular parts of it, have been contrived.

40. 1st. One of the most common methods of regulating the supply of water to a boiler is by the use of the float. This is understood to have been entirely successful in the low pressure boiler, the float being applied to raise a valve connecting a reservoir of water with the boiler to be supplied. A self-feeding apparatus in which a float was used was proposed by Mr. Charles Potts,§ who exhibited to the Franklin Institute a very neat working model, in which a glass boiler was kept at nearly a constant level by this

* In a certain theoretical case, namely, that in which all the heat to vaporize the injected water, is derived, from the hot steam, and the quantity of water which that steam can vaporize, without reduction of temperature below that of saturated vapour of the same elasticity, is injected, the precise reduction of elasticity has been calculated by M. Dulong. See Ann. de Chim. et de Phys., vol. xlviii., p. 378.

† Calculated from the formula deduced by M. M. Arago and Dulong from their experiments.

‡ Replies to Circular of Com. on Explosions, No. XX.

§ Journal of the Franklin Institute, vol. vi. p. 42, and also p. 327, &c., where the apparatus is illustrated by a figure.

method. Its application is most difficult in the case of a small high pressure boiler with interior flues.

Engineers differ very much in the amount of confidence which is to be placed in the float: those who have seen it in operation in the large boiler of a low pressure engine give it implicit confidence, others who have tried it in the small high pressure boiler consider its action too uncertain to answer a good purpose,* even when in its best form. If the objections to the float are not valid, and we apprehend that they are only partially so, the real difficulty will be found to lie in general objections to all self-regulating apparatus. This obviously is one which is liable to get out of order since it communicates between the exterior and interior of a boiler, and hence must have a packed joint, liable when the stem is not in constant motion to become tight, and therefore beyond the power of the change of buoyancy in the float to move.

41. A most ingenious method of feeding boilers was patented in 1825, by Mr. Eve.† It consisted of a revolving cock, bored in part through, and playing alternately into the boiler, and into a box of water. It was expected that this cock being placed at a proper level of the water within a boiler, would merely draw out and return water while this was at a due height, but when it sunk too low would draw out steam and return water. The difficulty of condensing the high steam‡ drawn out, and of making the returned water flow out of the openings, seems to have rendered this, as well as other promising schemes of the same sort, abortive.§ An attempt to obviate these objections which was seen by some of the members of this Committee was unsuccessful. Mr. Charles Potts‖ has recently proposed a plan which is similar in principle. It will have to encounter the difficulty of the flow of water from moderately large openings when the pressure on the two ends of the column is the same, and the necessity for the alternate heating and cooling of the revolving plug or chamber which acts as a feeder, and of at least a part of its contents. They agree entirely, however, with the Committee on Science and the Arts that this principle merits further trial.¶

42. The Committee are decidedly of opinion that no self-feeding apparatus has been, or is likely to be, invented which can be a substitute for the care of an engineer; and, indeed, they consider the carelessness which is liable to result from their use as a very serious, though not an insuperable, objection to them.

43. 2nd. Methods for ascertaining the level of the water in a boiler, or of giving notice when it falls to a certain level.

The imperfection of the gauge-cocks in ordinary use has been often pointed out, and indeed is generally admitted. Originating in the very infancy

* D. J. Burr on the explosion of steam boilers. Jour. Frank. Inst., vol. vi. p. 335. Mr. Redfield objects to its use in steamboat boilers, see Report to Secy. Tres. U. S. in Doc. H. R., No. 478, session 1831—2.

† Lond. Jour. of Arts, vol. xii. p. 230., Lond. Mechs. Mag. vol. vii. p. 344, Rep. Pat. Invent. vol. iii. p. 70. A revolving wheel for the same purpose has been patented by Mr. Jesse Fox. Jour. Frank. Inst. vol. x. p. 161.

‡ See also J. S. Williams' patent for supplying boilers with water. Jour. Frank. Inst. vol. vii. p. 183, which though different in action is liable to this objection, in even greater force.

§ Walker's feeding plug. Trans. Soc. Arts, &c., vol. L. part i. p. 63. Sliding valve and box. Lond. Mechs. Mag. vol. xxi. p. 376.

‖ Journal of the Franklin Institute, May, 1836, vol. xvii. p. 302.

¶ Report on a "Plan of a new pump for feeding steam boilers." Jour. Frank. Inst. vol. xviii, p. 3. 1836.

of the art in Savery's engine, they remain at this day, a stain upon its more mature age. At best,* when the water is tranquil within a boiler, they only show, roughly, the position of the water line; and when it is above the highest cock, or below the lowest, they fail entirely; and cannot be placed far apart without making their indications, within these limits, too rude even for practice. When a boiler is in action, particularly if it is small and contains high pressure steam, the foaming is so considerable as to interfere with their use. In the report of experiments by this Committee, abundant evidence is to be found of this imperfection; as an example of which may be taken the case, where by raising the safety-valve, of the small experimental boiler, indications of water appeared at a gauge-cock, below which the hydrostatic level was known to be nearly two inches.†

44. The method of indicating the level of the water by a float‡ is liable to all the objections urged against the feeding apparatus, depending for its action upon that instrument. It has not, however, except in very rare cases, been used in this country. An alarm float was tried by the Committee, which is not subject to the objection in regard to the stuffing-box, since it is entirely within the boiler. This is by no means a new device,§ though the particular arrangement was made by Mr. D. H. Mason for the Committee; and is figured and described in the first part of their report.‖ This device is intended to allow the escape of a small jet of steam whenever the water rises above, or falls below, a determinate level.¶ The alarm by the issue of steam through a trumpet tube, being only applicable to engines working at very low pressures, does not require special notice here.

45. With due care on the part of the Engineer, and the Committee are of opinion that no substitute has yet been found for such care, the glass tube affords the best means known to us, for observing the level of the water within a boiler. It seems strange that this excellent device which has stood the test both of experiment and of practice, has met with so limited a degree of favour. In the great progress made of late years, in the locomotive engine, it has been so clearly shown that engineers and their assistants can be induced to employ any machinery, the use of which is insisted upon, that the excuse of their indisposition to change should not be urged any longer. In this very case, in which the glass tube, is probably more exposed to fracture, than in any other, it is practically used. The objection on the score of its breaking by unequal expansion and contraction

* From the remarks which follow, exclusive of the objection on the score of the effect of foaming, we must except the shifting gauge-cock of Mr. Philos. Tyler described in Jour. Frank. Inst., vol. xv. p. 178.

† Report of Com. on Explosions, Part I. pp. 11, 12, &c. Jour. Frank. Inst., vol. xvii. pp. 9, 10. Peale on the height of water in boilers of locomotives, Jour. Frank. Inst., vol. viii. and Replies No. XXI. Potts on explosions. Jour. Frank. Inst. vol. vi. p. 329.

‡ The hydrostat described in No. XXX. of replies is inadmissible, from the interior of the boiler being occupied by a second cylinder leaving only an annular space for the production of steam. For the alarm floats of J. L. Sullivan, Esq., see Silliman's Journal, vol. xx. p. 1.

§ See the alarm float of Siebe. Lond. Jour. of Arts, vol. xiii. p. 273. The first of those known to the Committee.

‖ Report p. p. 14, 15, Plate 4, Fig. A. Jour. Frank. Inst. vol. xvii. pp. 13, 14.

¶ It is exposed to a slight objection from steam pressure acting to keep the disks upon the openings, these latter are, however, quite small, and the pressing surfaces of the disks may be regulated accordingly.

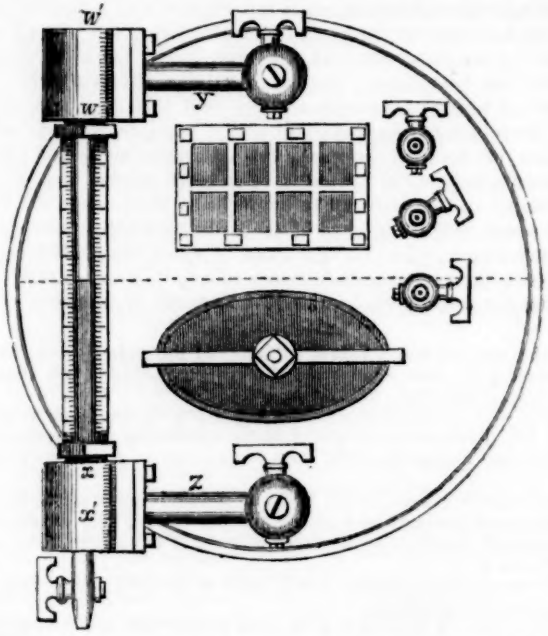
The float described by Mr. Ewbank, Jour. Frank. Inst. vol. x. p. 7, is also referred to by the Committee as deserving a full trial.

of the glass, and of the metal with which it is connected, has been obviated, by passing the ends of the tube into stuffing boxes; that on the score of its breaking by shocks, by giving it great thickness; and that of its breaking by sudden variations of temperature by using well annealed glass. The difficulty of the glass clouding when high steam is used, by the action of the steam on the alkali, is got rid of by using green glass. The experiments which the Committee made on this apparatus, were highly satisfactory and they confidently recommend its use to practical men.*

46. 3rd. The danger resulting from a deficient supply of water, being produced by the undue heating of parts of a boiler, many means have been proposed for showing such an increase of temperature, before it attains a dangerous degree. The fusible plates applied to the top of the boiler may be intended to indicate the general temperature of the steam when saturated with moisture or not, or the local temperature resulting from the rising of hot and unsaturated steam, produced by unduly heated metal.

* The following description of the tube water gauge used by the Committee is taken from the first part of their report, p. 12, &c. (Jour. Frank. Inst. vol. xvii. p. 10).

"The tube gauge is shown in the annexed figure. $w\,x$ is a tube of green glass passing into the stuffing boxes, $w'\,x'$; the stuffing enables an adjustment to be made for the unequal expansion of the glass and metal by heat, and prevents fracture on the subsequent cooling of the apparatus. y and z, are pipes connecting the tube with the boiler; these have conical terminations, by which the pipes are readily attached to, and detached from, the tubes connecting them with the boiler, which are provided with



stop-cocks: coupling screws might, in practice, be substituted for these conical terminations. To protect the tube, $w\,x$, from currents of air, it was surrounded by a second tube, loosely applied. A scale was attached to $w\,x$, to indicate the level of the water within the boiler.

In any case they will be exposed to pressure; though to less in the second case than in the first. The objections already urged, and derived from experiment, will apply to their use, in the ordinary way, in any one of these cases. Indeed without this objection, it appears that as the source of danger is the heated metal, to this the indicator of temperature should be applied.

47. Various methods of indicating the temperature of a part, or parts, of a boiler have been contrived. One of the most simple is to apply the common thermometer, inserting the bulb and as much of the stem as is necessary, in a tube closed at one end and fastened into the boiler. The tube should contain mercury, through which the heat is conducted to the thermometer. Such a tube may be placed at, or near, the water line of a boiler, at the fire end of a flue, or in general at the place of greatest exposure to heat from a deficiency of water, of which there will usually be one or more well determined, according to the form of the boiler. A mark upon the scale of the thermometer will show the temperature above which the metal must not be allowed to rise, either from an increased elastic force in the steam, or from a deficient supply of water. The fragility of the instrument, its inconvenient length, or position in certain cases, and its not acting as an alarm, are the principal objections to its use.*

48. The expanding rods proposed by Mr. Cadwallader Evans are ingenious; they give, however, not the local temperature of the boiler, but its general temperature, along the lines to which the rods are applied. A much more appropriate device, is the application of fusible metal proposed by the same gentleman.† This is intended to take the place of the ordinary fusible plate, and to avoid the difficulty, originally existing, but since remedied‡, of replacing the plate when it had fused. In the apparatus submitted to the Committee§ by their chairman, and subsequently made the object of experiment, the fusible metal is applied to the most exposed part of a boiler: it is so small in quantity, that it will serve to indicate a local temperature, while the motion which indicates its fusion is independent of the quantity of fusible metal. These instruments are intended, respectively to give notice when the steam, or the metal of the boiler is exposed to a temperature much below that which would produce danger. Both of them, after giving an alarm, can be immediately restored to action if the temperature within has been made to decrease.‖

* For a detailed description of the mode of applying the thermometer see the report of Com. on Expl. Part. I. pages 7 and 8, and Jour. Frank. Inst. vol. xvii. pp. 5, 6.

† Communication to Com. on Explosion, No. XXII. of Replies, &c. Jour. Frank. Inst. vol. ix. February, 1832. Patented in May, 1834. See specification in Jour. Frank. Inst. vol. xiv. p. 391. The Committee prefer this to the apparatus acting by the expansion of mercury.

‡ Hall's method of applying the fusible plate. Bulletin de la Soc. d'Encouragement, &c.

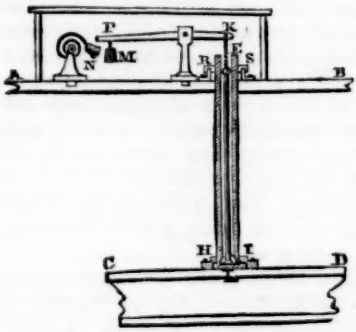
§ Described in Jour. Frank. Inst. vol. x. p. 217.

‖ The apparatus devised by the Chairman of this Committee, was made the subject of experiments, and, with them, is thus described in Part I. of the Report of Com. on Expl. It is obviously as applicable to a common boiler, as to one with interior flues.

"A tube of iron, or copper," according to the material of the boiler, "closed at the lower end, passes through the top of the boiler, its closed end reaching the flue to which it is attached." "This tube, it will be observed, affords a ready access to the flue, to ascertain its temperature, without any restraint from packing." "A mass of fusible metal placed at the bottom of the tube," "will become fluid very nearly as soon as the flue takes the temperature of the fusion of the alloy." "To show when the metal at the bottom of the tube becomes fluid, a stem is attached with a cord and

By very simple changes in the apparatus, the fusible metal might be applied to the boilers of locomotive engines.

weight," "or with a lever and weight." "The weight and longer arm of the lever, descending, may be made to ring a bell, or, by appropriate attachments, to turn a cock, permitting just enough steam to issue to give the alarm, and then to be closed at once. A projection on the lower end of the rod prevents it from being drawn from the metal until this latter is fused, and by widening the lower part of the tube, making it slightly tapering, the metal is kept from being drawn out by the rod."



In the annexed figure "AB is a section through the top of the boiler; CD, a corresponding section of its flue; EH represents a tube closed at the lower end, which is attached to the upper side of the flue. The mode of attachment by a projection on the tube and a ring screwed to the flue, is shown in the figure, as also the stuffing box RS, through which the upper end of the tube passes. The lower part HI, of the tube, is made tapering, to retain the fusible metal. KL is the stem, the lower part being inclosed by the fusible metal, the upper part attached by a chain to a lever KP. The weight M, draws the rod KL upwards, and on the fusion of the alloy HI carries the lever below the bell N, which being attached to a spring, rings an alarm."

The form of this apparatus, which was subjected to trial by the Committee, was essentially the same with that described. One of the tubes in which the thermometers were ordinarily placed, was used to contain the fusible metal, and as giving the more severe test, the short one entering only into the steam, was selected. For the convenience of removing the metal, it was placed in a metallic case, fitting loosely into the iron tube, and having a wire attached, by which it could be drawn out of the tube. This certainly diminished the sensibility of the apparatus, particularly, as the case was quite as thick as the enclosing tube, and as there was a small space between its convex surface and that of the tube; it was required, however, for the convenience of the experiments.

The results of the several trials are contained in the following table. The temperature was registered by the adjoining thermometer dipping into the water of the boiler, and already often referred to; it was raised as rapidly as possible in all the experiments except the first. The first four trials were made on an occasion specially devoted to this purpose, the last two were made incidentally when upon another subject.

Number of trial.	Temperature. Fah.°	REMARKS.
1	268	Stem rises. No particular attention paid to raising the temperature rapidly.
2	270	Stem rises. Steam raised rapidly.
3		Metal drawn out and suffered to cool, re-deposited cold in tube. Steam at 258°, and raised to 274° in 2½ minutes.
	274	Stem rises.
4		Metal drawn out and cooled. Steam at 250°, when metal was replaced. Steam rises at 274° in 3 minutes.
	274	Stem rises.
	252	Metal had become solid again. Steam let off rapidly.
5	270	Melted below this temperature.
6	256	Stem rises. Metal remains in a soft solid, so that the stem can be drawn out, until 240°.

A fact noticed during the experiments on fusible alloys was again verified in these;

49. *Second.—The undue heating of parts of a boiler may be produced by deposites.*

No cause of undue heating is better made out than this one, and the remedy is of the most simple kind.

The water of all rivers contains, in suspension, in greater or less quantities, the muddy particles detached from their banks or beds, and may contain in solution, salts derived from the same sources, or from the springs which supply the stream. The water of springs generally contains so large an impregnation of saline matter, as to decompose soap. The rivers of our Atlantic States, where perfectly fresh, contain few dissolved impurities, while many of those of the Western States are highly charged with calcareous matter. When waters holding substances in suspension, or solution, are evaporated, a sediment is deposited, varying in nature with the water employed. As the quantity of solid matter contained in the water varies, so the time required for such a deposite to take place, from the feeding water of a steam boiler, must be very variable. If a deposite is allowed to remain in a boiler, it gradually increases in thickness and in density; the heat which before passed rapidly from the metal to the water, is now impeded by a mass of viscid or of solid matter, which is a bad circulator or conductor of heat, and the temperature of the metal rises. The sediment thus heated increases in denseness, and may even form a hard crust upon the bottom of the boiler. A complete non-conducting coat is thus formed, which, if from its nature liable to crack or fissure, may allow water to have access to the heated metal below, and produce an explosion. This supposition is, however, as will be seen, by no means necessary to such a result. The most usual action of the sediment would seem to be as follows. When it has accumulated in thickness, sufficiently to produce a temperature in the metal, at which its strength is inadequate to bear the pressure without extending, it yields, and becoming more and more attenuated, finally bursts. It seems that the first yielding may bring water in contact with the metal so as to cool it, when the steam produced is not sufficient materially to increase the pressure within the boiler. Thus the attenuation may increase for a considerable time and gradually, and at last the bursting not produce any more injurious effect than to stop the working of the engine.

Accidental circumstances of figure, heat, &c., seem frequently to determine the places of deposite of these masses of sediment, but it is principally observed at the fire-end of the boiler, where its presence is most dangerous.

namely, that the mixtures of metals require a considerable time to change their state of solidity, or of fluidity, so that in the former case they may be raised, if heated rapidly, above the true temperature of fluidity, and in the latter case they may be cooled much below this temperature, without solidifying. The alloy used in these experiments appears to have put the apparatus very fully upon its trial in this respect, and the experiments were performed so rapidly as to give a further severe test. On the occasion devoted to the trials when the steam was not urged up with its greatest rapidity, the stem was drawn out at 268° when more rapidly at 270°, and with the fire at its maximum intensity, when the water was raised in temperature 24° in three minutes, the stem was drawn out at 274°. In other experiments it gave way at 256°. The range is 18° Fah. corresponding at ten atmospheres, to less than two atmospheres, under the test of very severe comparisons. There appears no reason to doubt, that when tested by no more rigid modes than practice would furnish, this apparatus would not only apply as an alarm to prevent undue heating of the parts of the boiler, but as a manageable, and useful check, in ordinary cases, upon the safety-valve. Report &c. Part I. and Jour. Frank. Inst. vol. xvii. p. 85.

50. The Committee have derived much information of a practical kind on this subject, and coming as it does from entirely different quarters of the country, where the water depositing the sediment was of different qualities, the details agree very remarkably.

Col. S. H. Long* describes a deposite found in one of the boilers of the Western Engineer, a boat used in the exploring expedition of 1818. The sediment had collected in less than two days so as to be two inches thick, and was found in parts of the boiler, where, from its construction, the heat was greatest. A difficulty in making steam enough for the supply of the engine, was observed, and induced an examination of the boilers, in one of which, the metal at a particular spot was found to have been made to project an inch and a half. In this case timely precaution prevented further evil consequences.

51. The plan of "blowing off" the lower parts of the fluid in a boiler, which is very generally used in turbid streams to the West, is, no doubt, of considerable service while the boat is running, but should never be used as a substitute for cleaning the boilers, when opportunity is afforded for this complete operation. Indeed it must be carefully executed, since if the flues are bared by it, any deposite upon them may become hardened before the boiler is replenished with water.

52. A practical engineer of New Albany, Indiana, Mr. Benton,† states that he has found deposites in boilers, used on our western waters, "almost as hard as the iron itself." These consist of a mixture of calcareous matter with the ordinary mud of the rivers.

The very consistent and satisfactory accounts given of the explosion of a boiler of the steamboat Caledonia, on the Mississippi, show that the disaster had its origin, at least in part, in the deposite within the boiler. The boat had eight connected cylinder boilers of wrought iron, for high steam, thirty inches in diameter and twenty feet long, with interior flues. The engine had been in operation for seven consecutive days, prior to the accident, and had, just before its occurrence, been stopped for about eight hours, to repair the machinery. During the time of stopping, the boilers were not blown out, and two hours after resuming the working of the engine the explosion occurred. On subsequent examination, it was found to have occurred in a patch, which had been put on the year before with *copper* rivets; the sediment on the bottom of the boiler was found to have been heated, so as to render it very hard. The rent began at about one-third of the diameter of the boiler from the bottom, that is, at, or near, the fire line, and passed upwards. The sediment had caused the heating of the copper rivets, and, it is probable, that the working pressure of the steam accomplished the rest.

53. The effect of a deposite of a different kind, in a boiler, near Richmond, Virginia, is well described by Mr. Burr.‡ The boiler was of wrought-iron, five-sixteenths of an inch thick; the water used for its supply was a chalybeate, but not so strong as to prevent its common use, as a beverage, by the workmen. A few weeks after the engine had been put in operation, a crack was observed in the boiler, just over the fire, and on examination, a deposite of oxide of iron was found in this place. The fire-end is stated to have been lowest in the setting of the boiler. A plate of wrought iron was substituted for that which had cracked. In four or five weeks a swelling began to form upon this plate, which continued to

* Replies to Circular of Com. on Expl. No. II.

† Reply to Circular of Com. on Expl., by Erasmus W. Benton, No. VIII.

‡ Jour. Frank. Inst., vol. vi. p. 354.

increase until it attained a considerable size, and in ten days from the first on which the protuberance had been observed, the boiler burst. No great damage was done. The iron was found to have been diminished in thickness, at the spot where the rent occurred, to one-eighth of an inch.

54. The deposites in boilers using salt water are no less dangerous. Mr. Lester* gives an account of the case of the boilers in the steamboat Eagle, of Boston, which leaked after being in use two or three weeks, and on examination were found to contain a deposite of from two to three inches thick, and which, in some parts, was so hard as to require the use of a hammer and chisel to remove it.†

55. Various other cases are on record of the effects of deposites in boilers, but the characteristic ones which have been selected convey all the information necessary. They show that no rule as to the time of cleansing a boiler can be general, and fully enforce the necessity for care upon this point. Farinaceous substances introduced into a boiler may tend to render frequent cleansing less necessary in cases of sedimentary matter, but cannot dispense with it.‡ Sound economy, as well as safety, require frequent cleansing of a boiler using hard or muddy water. The least that can happen, after the accumulation of sediment, is the injury of the boiler, perhaps its bursting, and a true explosion may result. Two violent explosions, at Bowen's mill,§ and at McMickle's mill in Pittsburgh, are fairly attributable to the effect of sediment, and there does not appear, in either case, to have been a deficiency of water at the time of the explosion.

56. The accidental introduction of materials which are bad conductors of heat within a boiler, may produce the same effect as the deposites just described. Mr. Benton‖ suggests that loose packing from the steam cylinder is sometimes passed through the force-pump and collecting under the flues, causes them to be highly heated. M. Arago mentions an instance of a rent made in a boiler, at Paris,¶ by the accidental resting of a rag on the bottom of the boiler.

57. Frequent cleansing of the boiler, or blowing out the lowest portions by small quantities at a time, are the true preventives to accidents from deposites. Besides them, however, the use of chemical reagents has been proposed for limestone water, and filtering in the case of muddy water.

* Letter to Sec. Treas. U. S. Replies to Com. on Expl., No. XVII. See also Jour. Frank. Inst., vol. vii. p. 289, &c.

† In a letter to the editor of the Jour. Frank. Inst., a gentleman of Boston, states that in a boiler using salt water, a deposite of more than two inches in thickness occurred in less than twenty days. Mr. West states that deposites, chiefly of sulphate of lime, occur in from one to six weeks of use, in the boilers at Manchester. See Jour. Royal Institution, vol. i. p. 42. See also F. Naested's letter to Sec. Treas. U. S., Doc. H. Rep. U. S., 1832-3, No. 478, p. 52.

‡ It was stated on the authority of Sig. Ferrari, that coarse charcoal prevents or removes deposites in boilers. (Jour. Frank. Inst. vol. ix. p. 420.) The Society of Arts of London awarded in 1833, a premium to Mr. Jas. Bedford for rendering deposites readily removeable by introducing sperm oil into the boiler. We are not aware to what extent this device has been tried. (Trans. Soc. Arts. vol. xlix. Part II. p. 88.) The use of grease for the same purpose is recommended in the Lond. Mechs. Mag. vol. vi. p. 308, and in the same Journal (Vol. ii. p. 206.) it is stated that the radicles of barley produced in the process of malting prevent deposites. These act on the same principle as the fecula of potatoes. They merely retard the formation of a deposite, and by rendering the fluid viscid, no doubt ultimately affect the generation of steam.

§ Replies to Circular, &c. No. XII. Letter of Thos. W. Bakewell, Esq. to Sec. Treas. U. S.

‖ Replies, &c. No. VIII.

¶ Used in producing steam to heat the exchange.

The former of these would prove but a partial remedy, and in unskilful hands would be dangerous, and the latter would probably be objected to on the score of its considerable expense. When the escape steam is allowed to run to waste this would be especially the case.

58. It has been also proposed to use boxes for collecting the sediment, but from them the Committee would not anticipate any very good result, though they might, in part, facilitate the cleansing of a boiler.

59. *Third.—The careening of a steamboat may expose parts of the boiler to heat without their being covered by water, and a subsequent return to its level will bring water in contact with the heated metal.*

There is no evidence known to the Committee that the careening of a boat has ever produced accident in any other than the small connected cylinder boilers, so extensively used in the boats navigating the western waters. In these, the danger has been forcibly pointed out by several correspondents,* and means of remedying it suggested.† These boilers communicate by pipes below the ordinary water level, and are supplied by the same forcing-pump. The fire is most generally applied to the exterior of the boilers, and they have besides interior flues. Being placed side by side, the length of the boiler being parallel to the keel of the boat, they occupy according to their size and number a more or less considerable portion of its breadth. The six contiguous boilers of the steamboat Helen McGregor, and the eight of the Caledonia occupied certainly not less than twenty-two feet in breadth of the boat. Calculating upon the dimensions of the boilers in the first named boat, and taking into view the circumstances under which the water has access to the heated metal, we find that a depression of nine inches, at the extreme boiler, taking place about the axis of the set of boilers, would expose a surface of boiler and flue together competent to supply, when the water returned upon them, one-third more steam than the ordinary working of the boiler could furnish: this supply being kept up, at an average, during the cooling of the elevated boilers to their ordinary working temperature. This danger might easily be met by an increased area of safety-valve, if indeed those commonly used would be insufficient, for the escape of the extra steam.‡ But the danger from even the working pressure acting upon the metal, of which the tenacity has been much decreased, is the real source of danger, and is not thus to be parried. There are but about 440 degrees of Farenheit's scale between the working pressure of eleven atmospheres, and a red heat visible in the dark.

This careening of the boat is liable to occur at every landing place and to last for a considerable time. Whenever a passing boat, an engaging view, or accident, shall call the passengers to one side of the boat it will be thrown out of trim.

60. In the small boats on our Atlantic rivers there are heavy carriages used to keep the deck level; these are also used in the English steam-packets which carry sails, but the Committee are not aware that they are employed in the boats of our western waters.

* The first communication made to the Committee on this subject was by James J. Rush, Esq. of the firm of Rush and Muhlenberg; by some accident the drawings presented by him were not deposited among the papers of the Committee, and a similar diagram to that of Mr. Rush being afterwards presented by Mr. C. Evans was published among the Replies to the Circular of the Com., No. XXII.

† Replies to Circular, &c. No. XXII. Earle on Explosions, Jour. Frank. Inst. vol. vii. p. 154.

‡ We are not able to make the calculation corresponding to this remark, not having the dimensions of the safety-valve, or valves, of the boilers of any one of the western Boats.

61. *Different modes of remedying the evil under discussion, and to be applied to the boilers themselves have been suggested.*

The first of these which came before the Committee, and which we believe has been applied in practice, was by Mr. James J. Rush. Doors are placed in the flues, at a point furthest from the fire-end, which, when opened, check the draught through the furnace and flues, and consequently prevent their becoming unduly heated. These are to be thrown open at each landing place. They do not, however, meet the case of accidental careening of the boat, unless made self-acting by expanding rods, as was proposed by Mr. Rush. They expose the flues to the action of air containing its full supply of oxygen, and must tend therefore to oxidize them more rapidly than in the ordinary wear of the engine.

62. The other devices before the Committee are those of Mr. C. Evans,* and of Mr. J. S. Williams.† The first places the mouth of the feeding-pipe just below the proper level of the water in the boiler, so that it shall be laid bare by a change of level, and the water be prevented from escaping from the higher boilers. This would remedy the evil, except in cases where the careening was sufficiently long continued to exhaust the upper boilers of water by the ordinary working of the engine; those boilers of which the supply pipes are bare not being likely to receive any supply from the pump. Mr. Williams places the supply pipes below the boilers and feeds through valves opening upwards, which of course prevent any return of water. The valves in this machine and also those proposed by Mr. Evans, to prevent any escape of water from the higher boilers, would be objectionable. The method of cleansing the pipes proposed by Mr. Evans is very ingenious.

63. After a careful examination of these devices, the Committee are of opinion that they present but partial remedies for the evils which they are intended to meet, and they consider that nothing less than detaching these boilers from each other, and feeding them singly, or at most in pairs, will prove effectual. They would therefore, respectfully, but earnestly, urge this upon constructors and owners.

64. *Fourth. Are there cases in which the metal of a boiler may become unduly heated when in contact with water?*

After much reflection and examination the Committee are of opinion that such cases *may* occur. They believe that such have occurred, though not frequently, and that with the common thicknesses of iron and copper boilers, and modes of arranging the furnaces, there is very little liability of their occurrence. Still it is well to recognise that such may be the case, as it may prevent accident by watchfulness in the use of a new construction of boiler, or application of the fire.

65. Mr. F. Graff‡ mentions specially an instance "in which the heads of the bolts burning off over the fire-place, and the joints parting;" "the boiling water passed into the ash pit." From his known carefulness, there is no reason to suspect that there was sediment in this boiler, which was one of the low pressure boilers used at the Philadelphia water-works.

66. Mr. Hebert§ gives two cases, in the first three different rents of an

* Replies to Circular, &c. No. XXII.

† Jour. Frank. Inst. vol. viii. p. 289. The method adopted by Mr. W. C. Redfield, places the means of feeding separately, or in the connected way, within the control of the engineer. This was not presented to the Committee, but may be found alluded to in the Documents of the House of Representatives of the United States, 1832-3, No. 478, p. 17.

‡ Letter to Councils. Replies to Circular, &c., 4th of No. I.

§ Replies, &c. No. XI.

iron boiler occurred at the same spot, at different times. Previous to the first "disruption, there was observed a bulging, or swelling out, of the metal, which gradually increased until it became nearly of a hemispherical figure, when it burst open and let the water out of the boiler into the fire. The boiler was repaired by putting a thick patch of malleable plate iron over the hole, when after about six weeks wear and exposure to the fire, this metal bulged out again, and burst asunder; a third patch was substituted, and in about a similar period of time was destroyed in like manner." "The cause of these ruptures appeared upon investigation to be owing to a partial and very intense heat impinging against that particular spot where they took place." If to this detail had been added proofs that the first rupture was not caused by sediment, nor by a defect in the metal, the evidence would have been complete. It is not, however, probable, that either of these causes were actually operative, since the second and third plates are stated to have bulged out, in the manner of the first, and if sediment had collected at this spot, it could not thrice have escaped notice. The defect in malleable iron, to which the Committee alluded above, is the want of connection in parts of a plate, resulting from imperfect welding before rolling, and which sometimes separates the plates into distinct layers, for a considerable extent.

In the communication just referred to, Mr. Hebert further states, that the disruption of a boiler, occurring twice in the same place, was traced by Mr. John Martineau, a respectable engineer of London, to the impinging of a current of air upon this spot.

67. A case apparently of the kind now under discussion, but which was found subsequently, to be due to the imperfect union of the parts of a sheet of metal of the boiler is as follows: Part of a boiler belonging to Messrs. Merrick and Agnew, of this city, was observed to be protruded, in a similar way to that described by Mr. Hebert. Suspecting the presence of sediment, the boiler was examined and found to be clean. It was a cylindrical boiler, of wrought iron, the fire applied on the exterior and at one end, and without interior flues. The fuel was anthracite coal. The effect was next attributed to the intense local heat produced by this fuel, and the grate bars being lowered the swelling made no further progress. It has been since ascertained that there was a separation into laminæ of the iron, at this place, requiring the removal of part of the sheet.

68. While, then, the evidence in the cases preceding the last is certainly incomplete, the Committee conceive that they are leaning towards the side of safety by admitting the possibility of the occurrence of danger, to the engineer and fireman at least, from peculiarities in the arrangement of a boiler, or of the fire which heats it.

69. In these remarks it has been supposed that there is a considerable column of water over the metal; if that should not be the case it may well happen that the steam-bubbles will form so numerously on, or near, the iron as to allow it, while they rest there, to become heated above what it would be, if the water were in absolute contact with the metal.* This will especially occur with a viscid fluid, such as salt water, or water with much sediment suspended.

70. The views suggested by the several sections of the preceding head are the following:

* Replies, &c., No. II. Communication of "an Engineer." Philos. Mag. vol. i. p. 403.

1. The feeding of a steamboat boiler should not be done at intervals, but go on throughout the working of the engine.

When the engine is stopped, as at a landing, or to take up passengers, &c., the water should still be supplied by the engine itself, or by a subsidiary one, or by hand. In this case the free safety valve should be raised. The practice of wasting water by opening a valve, when the forcing-pump is not in action, is considered dangerous.

2. If the water should by any accident get down so as to expose a flue or flues, the fire should be in part extinguished, to cool the boiler before adding water. If the engine is at rest, in such a case, it should not be put in motion. If it is in motion it should be slackened, or stopped, the furnace doors opened, and the heat got down. Then water may be drawn in. The opening of a safety valve should in such a case be avoided. The engineer should remember that as life is at stake, he cannot be too prudent.

Such a condition of things, however, ought never to be allowed to occur, and the responsibility for the danger which results must rest upon the master, the engineer, and his assistants.

3. If a self-regulating apparatus for the supply of water is used it should be closely watched, and on no account be implicitly trusted to. It may be a convenience, but can, in no case, be a substitute for human care.

4. For ascertaining the level of the water within a boiler, the Committee recommend the glass tube water-gauge, a form of which is shown in the foregoing pages (p. 296).

5. The Committee recommend for every boiler a fusible metal apparatus, the metal of which shall be inclosed in a tube, so as not to expose it to pressure.

In boilers without flues it should be attached at the water-line; in those with flues, at the highest part of the flues; or if level, at the part likely to be most rapidly heated, as at the juncture of several flues into one, a sudden change of direction, or the place of most active combustion of the fire.

The form described in the report (pp. 297–298,) is convenient, and the lever should act upon a bell, and upon a small cock. The apparatus should be inclosed, the master of the steamboat having the key of the inclosure, which should further be so arranged as to protect the apparatus from the weather.

The quantity of metal should be no greater than is required to keep the rod in its place. The metal should be regulated so as to melt at a temperature of fifteen degrees* above that corresponding to the working pressure. Tables for this purpose, will be found annexed.†

* This difference of pressure corresponds at a pressure of two atmospheres, to half an atmosphere or one-half the bursting pressure, and at eleven atmospheres to rather more than two atmospheres, or one-fifth of the bursting pressure. The difference is not, however, too great at low pressures, because an excess of strength may rather be expected in the low pressure boilers as now made, and the alloys, containing bismuth, pass through the different states from solidity to liquidity, by slow degrees.

† While correcting the proof sheets of this No. of the Journal, we notice in the London Magazine of Popular Science, for last month, (September, 1836,) a paltry criticism of this proposition of the Committee—"to enclose the fusible metal in a case in which it shall not be exposed to the pressure of the steam, but only to its heating effect."—After quoting the sentence, the Magazine critic, triumphing in the fancied discovery of a good American bull, exclaims—"but *cui bono?*—for what purpose?—the metal is in a case! not exposed to the pressure of the steam! How then is it to act efficaciously as a means of relief to a boiler dangerously increasing in temperature? *How is it to act at all*, though fluid as in a crucible?" The conclusion he then arrives

If the metal is melted, the injection of water, or the opening of the furnace doors, will reduce the temperature of the heated parts; or lower the pressure of the steam if that should have been too high, and the safety valves be out of order.

By sounding with the rod, it will be ascertained when the metal is about to recongeal, as it becomes a soft solid into which the rod may be forced. If, accidentally, the metal congeals without taking in the rod, the end of the latter being heated, will melt the fusible alloy.

If the safety-valves do their duty, this metal will never be melted by increase of temperature, caused by an increase in the elastic force of the steam.

6. The true remedy for undue heating of boilers by deposites is frequently cleansing them. When this is impracticable, blowing out should be cautiously resorted to, so as not to lay the flues bare of water. The danger from these deposites is especially great in salt water, and muddy water mixed with calcareous matters. It should be guarded against by ascertaining the time required for the water used, to make a sensible deposite. No general rule in regard to this can be given, since boilers in different places and even those fed by springs at short distances apart are liable to deposites in different times.

Negligence on this point will always produce the rapid destruction of a boiler, and may cause it to burst, or even to explode.

No substitute for the care just recommended, has yet been found.

7. The following table of fusible alloys applicable to boilers working at pressures from one to thirteen atmospheres, is deduced from the experiments of the Committee.* The alloys are those determined approximately, which at temperatures severally 15° Fah. above the working temperatures will allow a metallic stem to be drawn out from the mass. The principles which guided the Committee in their experiments may be seen by referring to Part I. of their Report (p. 36, &c.) The proportions are given in parts by weight.

Table of alloys for use in closed tubes, and with a metallic stem.

Working pressure in atmospheres.	Tin.	Lead.	Bismuth.	Working pressure in atmospheres.	Tin.	Lead.	Bismuth.	Working pressure in atmospheres.	Tin.	Lead.	Working pressure in atmospheres.	Tin.	Lead.
1½	8	8	7.5	4	8	8	3.4	8	8	8	12	8	12.3
2	8	8	6.2	5	8	8	2.2	9	8	9.8	13	8	13.2
2½	8	8	5.3	6	8	8	1.2	10	8	10.6			
3	8	8	4.6	7	8	8	0.5	11	8	11.4			

(TO BE CONTINUED.)

at is,—"There must be a district in Pennsylvania where the Shamrock is worn"! And he further thinks, that our sage Committee would be likely to propose, as the best means of preventing the loss of a key which would alone open a box, to *shut it up in the box!* We recommend to this ingenious critic to read this part of the report of the Committee carefully over again, and try whether he can discover no good reason suggested for enclosing the fusible alloy in a tube,—and no substantial answer to his *cui bono?*—If his own vision should fail him, perhaps he will do us the favour to borrow that of some *intelligent* friend. We are not aware that the "Shamrock" is at all indigenous to this country, though we have thistles and thorns a plenty. G.

* Report of Com. on Expl. Part I. p. 36. Jour. Frank. Inst. vol. xvii. p. 86.

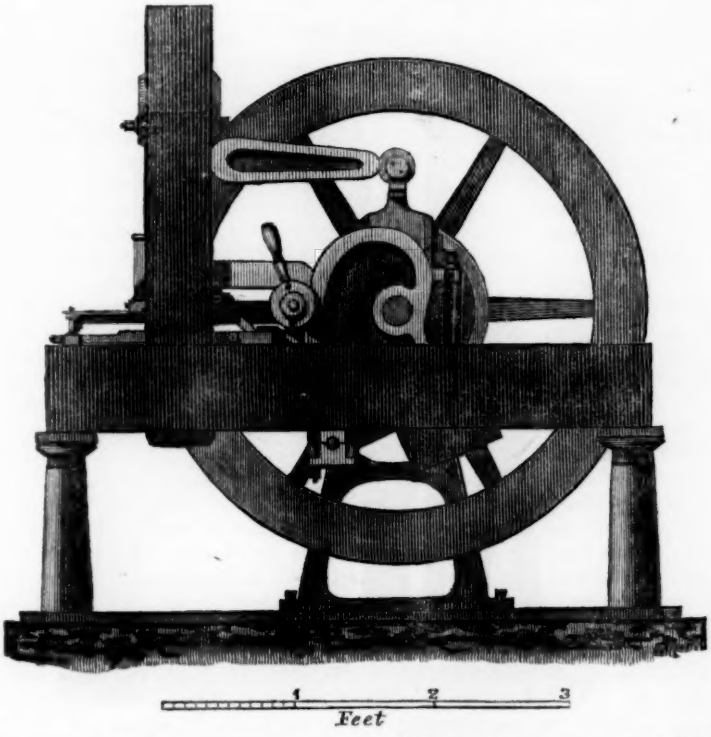
Description of the new Coining Presses lately introduced into the U. S. Mint, Philadelphia. By Franklin Peale, Esq.

TO THE COMMITTEE ON PUBLICATIONS.

Gentlemen:—After seven months of experience, it will not be considered premature, to send for publication, a brief notice of the Coining Press, a model of which I had the pleasure to exhibit and describe, at one of the Conversation Meetings at the Institute last year.

This press has been in operation since the 23rd of March last, the period of the first coinage by steam in the Mint of the United States; and the results, which are more than satisfactory, have authorized us to proceed with the most perfect confidence in the formation of the presses for the Branch Mints at New Orleans, and at Charlotte and Dahlonega, in North Carolina and Georgia; also, with the manufacture of others for the use of this Mint, all of which, it is probable, will be completed at an early period in the coming year.

Side view of the Press.



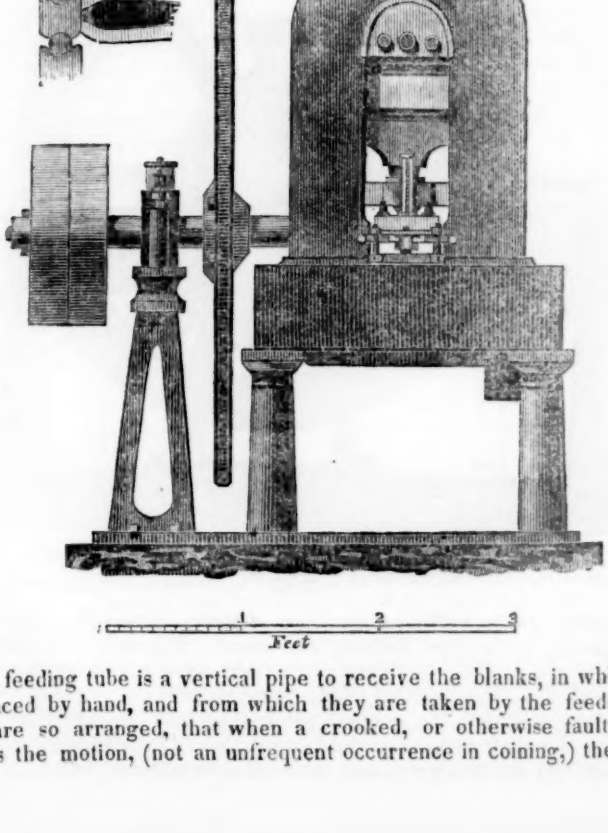
The above design exhibits a side view of the medium size press, intended to strike eagles, quarter dollars, and cents. Three grades have been adopted, corresponding in linear proportions to the numbers 9½, 7 and 6, suited to all the denominations of our coin respectively.

The design exhibits the general proportions and arrangement of parts, consisting of a shaft with a fast and loose pulley to receive motion by means of a strap from the moving power, whether water, steam, horse, or hand:—

the latter, of course, being least desirable, will only be used, when neither of the others is available. Upon this shaft is placed the fly wheel, the momentum of which, during one revolution at the rate of sixty per minute, is found, on trial, to be quite sufficient to overcome the resistance offered by the piece whilst subjected to the pressure of the dies. Upon the same shaft is the crank, which gives motion, through the pitman, to a lever and toggle-joint, the structure of which is exhibited in the left upper corner of the front view presented in the next figure.

The feeding in of the blanks, or planchets, and their discharge after being struck, is performed by an eccentric and set of levers, all combined in so simple a manner, as to be effectual, and not subject to derangement; as much of these parts as are visible in the two views, are faithfully exhibited, but it is impossible to describe them intelligibly without the aid of drawings of the separate parts; and, further, since the drawings were executed, changes have been made in the position and form of the eccentric, by which the press has been much improved; a general notice is all that is intended in the present communication.

Front view.



The feeding tube is a vertical pipe to receive the blanks, in which they are placed by hand, and from which they are taken by the feeders; the latter are so arranged, that when a crooked, or otherwise faulty blank impedes the motion, (not an unfrequent occurrence in coining,) the whole

is immediately released from action, and will not again operate until the impediment be removed.

A few familiar facts are added as evidences of the peculiar adaptation of the toggle-joint to coining, as proved by the operation of the press which is the subject of this notice.

1. The pressure acts with increasing force until the close of the operation, at which time its intensity is greatest, and it is always carried to the same extent.

2. No injury occurs from the absence of a blank from between the dies when the blow is given, an accident that results in the destruction, or great injury, to one, if not both, of the dies, in presses of the ordinary construction.

3. An immense saving of labour. From trial, we have ascertained, that a man, with one hand applied by means of a common winch handle, can coin eighty pieces per minute, (the experiment was tried upon cents, which have a diameter of $1\frac{1}{10}$ inches,). A boy, fourteen years of age, was able to coin sixty per minute, without any unusual exertion; and lastly, it was impossible for the operator to tell, by the resistance offered to his exertions, whether the pieces were being coined or not.

It is by no means my wish to be considered the first who has applied the toggle-joint to the striking of coin. It is difficult to say to whom priority belongs; for presses on similar principles, are in use in more than one city of Germany, and their successful operation was witnessed at Carlesrhue, in the Grand Duchy of Baden. Particular advantage has also been derived from a careful examination of the coining presses of Monsieur Thonnellier of Paris. It is just to observe, that none of these presses were perfectly satisfactory. I have, therefore, made my own distribution and proportion of parts, thrown off whatever was complex, and added such as were necessary to its perfection, particularly, the arrangement for the disengagement of the feeders in case of the presence of defective pieces.

Our esteemed friend and fellow-citizen, Mr. M. W. Baldwin, several years since, commenced the construction of a press on similar principles. His talents and mechanical skill are amply sufficient for its completion; and it is to be regretted, therefore, that his numerous occupations have prevented his prosecution of the subject.

I take advantage of the present occasion, to make a few remarks on the application of steam power to coinage, as applied in the Royal Mint, on Tower-hill, London, which is one of the greatest curiosities in mechanics that I have ever seen, exhibiting consummate skill and great resources, on the part of the inventor, who, if I am not misinformed, was Mr. Boulton of Soho Works. For a series of years this machinery was kept rigidly secret; some even of the officers of the Mint not having the favour of seeing it accorded to them, and it might yet have remained so, if it were not for the advancement of liberal principles, which bid fair to keep pace with the rapid increase of mechanical ingenuity and skill.

The direct application of high steam to the screw press, would have answered every purpose, but still better, the substitution of the toggle-joint for the screw has rendered all this ingenious complexity unnecessary; but mechanicians may make their own inferences from the following sketch.

A low pressure engine, is employed to create a vacuum in a large *receiver*, (in this case a misnomer,) by means of an air pump, which serves as a reservoir of power, through the agency of which the pressure of the atmosphere, is exerted as occasion requires, both for the *blow* and *recoil* of the screw press, the former, produced by a cylinder and piston, furnished with valves, one of which opens to the reservoir, and the other to the exter-

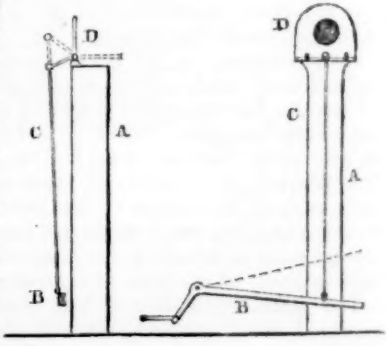
nal air, the latter, by a cylinder and piston, constantly acting, but with less power than the former. The valves are moved by levers which are struck at the proper time by a *plug frame* of similar construction to those employed in the ancient atmospheric engine. The power is communicated to the screw by tumbling shafts, connecting rods, and levers, the construction and operation of which could not be rendered intelligible without full drawings for reference. More words would, perhaps, render this brief notice as mysterious as the contrivance of which it treats; I will, therefore, close, by adding that eight of these systems, attached to eight screw presses, constitute the coining power of the British Mint.

On the management of Turn-outs on Rail Roads. By A. C. Jones, *Engineer.*

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Gentlemen:—At the present rapid rate of traveling on rail roads, it is a desideratum (in point of safety,) to know that the switches of the turn-outs are in the line of the road, so that the train is not necessitated to be much checked, in passing over them. The best method for insuring the right position of the switches, is that used on some short roads, by having a man stationed at them; but on long lines of road, where there are many turn-outs, this is not practised, owing to the expense attending it. As a substitute, a ball is placed on the end of the lever used to shift the switches, to show their position. This, I believe, is the best plan in use; that it is defective is proved by the numerous accidents occurring on rail roads by running off at the turn-outs, it not being foreseen that the switches are wrong. Where the turn-out is in, or at the end of a curve, it is difficult to tell by the ball how the turn-out stands, until you are so near as to make it impossible to stop in time, if it is not right.

The following arrangement will have a tendency to promote safety in this particular, and the additional expense will be but trifling. Instead of the ball, I propose having a board placed on the post, its face at right angles to the road, with hinges fastened to one edge, and from its face extends a short lever, which is connected to the lever that moves the turn-out, so that when the switches are changed, the dial, or board, takes either the horizontal or vertical position. This will be shown more fully by an inspection of the cuts.



On a curve or grade, this method would have the same advantages as on a straight part of the road, and it is evident, the face or edge being presented to the engineer, that he will be thereby enabled to judge how the turn-out stands, at a greater distance from it, than by the method in practice, and will consequently admit of his stopping the train in time to prevent accidents.

A. The post. B. The lever. C. Connecting rod. D. Dial.

Respectfully, yours,

Philadelphia, Sept. 1836. A. C. Jones.

This appears to be a good suggestion. A board, or disk, with a black circle in the centre, surrounded by a broad white border, would be more

conspicuous, and its position, in the way proposed, more easily perceived than the ball now in use. In turn-outs that are much used, it may be expedient to keep a lamp burning during the night, to show the position of the disk. It seems desirable, however, that every precaution should be taken to prevent the necessity of stopping a locomotive train in order to adjust the switches of a turn-out. J. G.

Franklin Institute.

COMMITTEE ON SCIENCE AND THE ARTS.

Report on Mr. C. Kenzie's Water Wheel.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania for the promotion of the Mechanic Arts, to whom was referred for examination the model of a Water Wheel, invented by Mr. C. Kenzie, of Troy, New York, REPORT:—

That they have carefully examined the object submitted to them, and find that it is a modification of the tub and the undershot wheel. The peculiarity of the invention consists in receiving the water from a number of chutes at once, distributed around the periphery of the wheel. The buckets or float-boards, are set in the direction of the radii, and the water is directed as nearly as practicable in the line of a tangent to each float. In this arrangement the water is, of necessity, discharged from the wheel within the rim, or shrouding, and is allowed a free escape on both sides of the wheel. The wheel is placed in a horizontal position, at the bottom of the fall, entirely under water, and is surrounded by a box or tank of an equal depth with the wheel, to which it is accurately fitted to prevent the escape of water between them, whilst it permits the latter to revolve freely.

The supply of water is through a water-tight trunk connected with the tank, by which the entire head and fall is made available, the wheel being sunk below the lower level as before stated.

One of the benefits arising from this arrangement, is that of the water being received on the wheel in a compact form, owing to the spaces being kept always full by the centrifugal force. A principal advantage, however, is that of being able to employ a much greater quantity of water than could be brought to bear upon the floats by any other wheel of equal size.

The Committee believe that the advantages above enumerated, are in accordance with the principles of hydrodynamics, and that its inventor has attained a high degree of perfection in that description of wheel, and they are happy to add, that so far as their knowledge extends, the arrangement is new.

The Committee take leave to suggest, that since the water always retains a part of its power, proportionate to the square of its velocity, on leaving the wheel, no inconsiderable portion of it would be saved in this instance by extending the buckets to the centre, so as to deliver the water at as low a velocity as possible; and they would also recommend the use of a partition which should cause all the water to take the same course in the floats. In this case the rim must of course be made wider so as to contract the diameter of the opening to what would be just sufficient for a free delivery of the water.

By order of the committee.

Oct. 13, 1836. WILLIAM HAMILTON, *Actuary.*

Report on Mr. Holcomb's Reflecting Telescope.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania for the promotion of the Mechanic Arts, to whom was referred for examination a Reflecting Telescope, made by Mr. Amasa Holcomb, of Southwick, Massachusetts, for the Newark College, Delaware, REPORT:—

That the following description of the instrument is given by Mr. Holcomb: "The telescope submitted to the examination of the Committee is a Reflector on the plan of Sir Wm. Herchel. It is fourteen feet long and ten inches in diameter. It has six different magnifying powers from 70 to 1000."

The Committee proceeded to the examination of the telescope on the evening of the 17th instant. A trial was made of its various powers from 70 to 1000, upon the moon, upon several nebulæ, clusters, and double stars, and they beg leave to report as the result of that examination, that the instrument possesses all the superiority over any reflectors hitherto submitted by Mr. Holcomb, which its increased length and aperture would lead us to expect, and that it has every attribute of excellence which the best optical skill could give to an instrument of these dimensions. The Committee cannot forbear again commenting upon the excellence and simplicity of Mr. Holcomb's method of mounting the instrument, which notwithstanding its size, is portable, with all its mounting, by a single person.

The object is easily followed by the rack work and the inconvenience from the motion of carriages at short distances from it, was not found to be greater with a power of 1000, than with a power of 100, in the common mode of mounting achromatics, moveable by rack work on an upright stand.

The short time allowed the Committee prevented them from making observations on close double stars, for the purpose of determining the limit of its optical capacity. All of which is respectfully submitted.

By order of the committee.

Oct. 13, 1836. WILLIAM HAMILTON, *Actuary.*

Mechanics' Register.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN MARCH, 1836.

With Remarks and Exemplifications by the Editor.

1. For a machine for *making and Cutting Crackers;* William R. Nevins, city of New York, March 2.

A claim is made to "the peculiar arrangement of the machinery as described, by which the operation of the rolling of the dough, and cutting the biscuit, or crackers, is performed at the same time and with the same machine. Also, as an improvement, the horizontal rack or pinion by which motion is given to the cutters."

The description of the machine is very imperfect, and the drawing lends but little aid in exhibiting the "peculiar arrangement" of its parts. There are to be two, or more, pairs of rollers to roll out the dough; a moveable table, or apron, to carry it under the cutters, and the frame carrying these cutters is to be raised, we believe, by cams, or lifters, and is to fall by its own gravity. There are many other machines in which the rolling and cutting are performed at the same time, this, in fact, is common to the numerous instruments which have been contrived for making crackers.

2. For a *Power Printing Press;* Isaac Adams, city of Boston, Massachusetts, March 2.

We cannot attempt to give any description of this press, the specification of which occupies sixteen pages, with numerous references to the drawings; the claims amount to twenty-one in number, and it will be a fortunate, and very remarkable, circumstance, should the whole of them prove tenable. The press has been tried, and we are informed that it operates well, and is much superior to that patented by the same gentleman, which was itself a good one. The combinations in the present instance are sufficiently novel and characteristic to render it unnecessary to resort to minute particulars in the claims, a course which is commonly pregnant with danger; if one thing only that is essential to the existence of a machine is claimed, it is safe to trust to this alone. In the case before us, we could point out more than one thing claimed which is not new, and the patentee himself informs us respecting one of them, that "the claim last above written, on the nippers, is not to extend to cylinder printing machines;" a court and jury, we apprehend, would not regard such a limitation.

---

3. For a *Stove for Cooking and Warming Rooms;* Foster Stevens, Springfield, Hampden county, Massachusetts, March 2.

The general form of this stove, as represented, is that of the common Franklin, or open, stove; but in this form it is to be used for heating only; when employed for cooking, a close, or box, fire place, is produced by means of two plates hinged together, and folding up against the back of the stove; one of them, when unfolded, forms the top of the close stove, and has perforations for cooking utensils; the other makes the front, and has folding doors to supply the fire. There are wing plates, which when not used to complete the enclosure, fold against the sides of the stove.

The claim is to "the combining the cooking stove with the common fire place, or fire frame, by means of the folding plates and wings, and the closing of the lower flue by means of the plate when folded back, so as to cause the smoke and heat to pass off as in a common fire place."

Such folding plates are apt to be troublesome, and are liable to get out of order, by warping from heat, the insinuation of ashes, &c. about the joints. Should there be no difficulty of this kind, we are not aware of any thing which will interfere with the claims of the patentee.

---

4. For *Apparatus for heating buildings, and for Cooking;* Lovell Lewis, Lewiston, Niagara county, New York, March 2.

A stove of any of the usual kinds is to be employed for the combustion of the fuel, and this is to be surrounded by a casing of tin, allowing a space between them; the stove pipe is to be surrounded in the same way by a tin case, which is to be closed at top. From this casing tubes are to lead into any part of a building to be heated; and when cooking is to be performed, the articles to be operated on are placed within the casing, which is furnished with doors for that purpose. The claim is to "the method, or manner of collecting, retaining, conducting, and using, heat, for the purpose aforesaid."

Although we have good and bad conductors, and good and bad radiators of heat, we cannot by any of our devices, bottle up, and retain this subtile medium, as we can bottle up and retain water; neither will it, at our bidding, pass through tubes, or be drawn off by pumps and cocks, in the manner of

liquids. But apart from this, the foregoing description sets forth no new discovery, as tin cases to stoves and furnaces intended to arrest and retain the heat, are well known devices, and have been made the subject of patents in various instances.

---

5. For a *Washing machine;* John O. Geer, Norwich, Connecticut, March 2.

A cylindrical barrel is to be placed horizontally, and within it are to be revolving dashers. "The construction of the inside movements, and the operating of the same," constitute the claim.

---

6. For a *Safe for protecting account books, &c. from destruction by fire;* Daniel Harrington, city of Philadelphia, March 2.

A firm enclosure is to be built of brick, or stone, extending from the cellar up to the floor of the apartment in which the safe is to be used. The safe itself may be made of wood, and is to be suspended by pulleys and a counter weight; sliding and folding doors of iron shut down over the safe, when it descends into the fire proof case, or well; these being of sufficient strength to prevent any danger from walls, or rubbish, falling upon them, and being so contrived as to be, to a certain extent, self-acting, covering the safe as it descends. The particular devices we cannot take time to explain, but think them such as are well calculated to answer the purpose intended.

---

7. For *Cutting and forming heads for barrels, &c.;* Hiram Andrews, Canaan, Litchfield county, Connecticut, March 2.

Various machines are in use for cutting heading for casks, &c., but that described in the specification of this patent appears to be sufficiently new to justify a claim to invention. The heading is to be cut rounding by means of a concave, circular saw on a revolving shaft, within which saw there is a circular cutter, of somewhat less diameter than the saw, and in contact with it, furnished with teeth so formed as to give the proper bevel to one side of the head. A similar cutter on another shaft bevels the opposite side of the head, the latter being properly secured on a revolving platform, operating as a chuck. The drawing is very indifferently executed, affording but a general idea of the machinery, and is, therefore, not such as the law requires. The specification affords a good general description, but no more; and the claim is to "the combination of the several parts of the machine, and the placing them in the position which effects the object of cutting and forming heads for any casks of any dimensions." Such a claim we do not think good, as it does not designate any particular combinations, as characteristic of the machine, whilst several of the things combined, have been similarly arranged in other machines, for the same, or other purposes.

---

8. For a *Self-sharpening pick for dressing mill stones;* Samuel Etheridge, Tecumseh, Lenawa county, Michigan, March 2.

This invention is claimed as applicable to stone hammers, as well as to picks for mill stones. The hammer, or pick, consists of two pieces of iron, embracing a plate of steel between them; to one of these pieces the handle is fastened, by passing through it in the usual way, and against this the other piece, or jaw, is to be forced by means of a wedge, so as to hold the steel plate firmly.

CLAIM. "What I claim as my invention, and not previously known, in the above described pick axe, and chisel, is the making of the point or cutting part a separate and distinct piece from the body; the manner of holding it between two jaws held together by a strap, with the key, or a screw; the manner of sliding it down and fastening so that it will not drive back again; and the making of the point of one thickness of steel between two of iron welded together, so that the iron will wear off faster than the steel, and thus constitute a self-sharpening point."

By turning to page 25, vol. xvi., it will be seen that the first member of the foregoing claim is in terms which cannot be sustained.

---

9. For an *Instrument for perforating Wood;* John B. Pell, city of New York, March 2.

This perforating instrument consists of a cylindrical steel tube, well polished within and without; it has at one end a cutting lip, and, if preferred, an entering screw, and at the other there may be a handle like that of an auger. The tube is somewhat smaller at the cutting than at the handle end, and the chips which pass into it are, consequently, not obstructed in their passage through it. Besides the perforating instrument, the specification describes and claims a machine for working and directing it, by means of a guide screw, and other appendages.

CLAIM. "What I claim is, first, the tube perforator which casts its cuttings through the tube or heart of the instrument, and bores without clogging with its own cuttings; and, secondly, the labour saving machine for giving a rotary motion to the perforator, more advantageously than by a handle worked in the manner of a common auger."

---

10. For an improvement in *Piano Fortes;* Isaiah Clark, Cincinnati, Hamilton county, Ohio, March 2.

The patentee states that he makes an entire and distinct frame of iron, which frame is to bear the whole strain of the wire, or strings, and claims "the entire iron frame, made of cast or wrought iron, or any other suitable metal; also the sounding board, on account of its being attached to the said frame; and also the peculiar direction of the treble strings." The treble strings are nearly at right angles with those of the bass.

We did not suppose that there existed a single piano forte maker who was unacquainted with the fact that pianos had been made with *entire iron frames*, in France, England, and the United States; it appears, however, that we were mistaken.

---

11. For a *Brick Press;* Phineas Ball, Mount Vernon, Knox county, Ohio, March 2.

This machine is intended for pressing untempered clay by what is denominated the double-actioned joint levers; the main point depended upon appears to be the pressing of the brick clay in the mould by a follower on each side of it, one working up, and the other down. The general construction of the machine is shown in the drawing, but there are several particulars not so explained as to enable a workman to construct a complete machine. The claim is certainly broader than the invention; it is to the giving to the levers that double action which causes the material to receive an equal pressure from above and below; and also the invention of pressing the brick on the edge, or face; likewise the improvement in the art of making brick by pressing untempered clay; together with the general com-

bination and arrangement of the respective parts, as herein described, by which this machine is distinguished from all others constructed for the same purpose."

We are confident that bricks have been pressed by double followers in machines previously made, and there are numerous patents for making brick by pressing untempered clay.

---

12. For *Forge furnaces, and steam engine boilers, in combination;* Alexander Harrison, New Haven, Connecticut, March 2.

The body of this combined forge and furnace is represented as nearly egg-shaped; into the lower part, or air chamber, the wind is to be forced, and is to pass up through a grate upon which the fuel lies; the furnace, or forge, occupying the middle portion of the apparatus; into this part there are several openings, or doors, giving access to the fire; the upper part of the egg-formed body constitutes the boiler, which in part, also, surrounds the fire.

The claim is to the "combination of a steam engine boiler with a forge furnace, constructed substantially as aforesaid; that is, with a boiler so formed as to constitute the sides and top of the forge furnace."

There are several things alluded to, which are not explained; the use and application of the apparatus are also very vaguely presented.

---

13. For a *Saw mill dog, or carriage stock;* Jesse Reed, Marshfield, Plymouth county, Massachusetts, March 2.

Various modes of forming dogs for holding, and slides for setting, the logs on saw mill carriages, have been made the subject of patents. The things claimed by the present patentee, are a "notched slider, a hand, weight and lever, a lock joint of a knee, a swivel brace, right angled dogs, and the method of confining them, as described, with their arrangement." Some of the parts individually claimed are not new; as, for example, the *notched slider*, which is a bar of iron forming a rack on its lower edge, and having the right angled dogs on its upper side. The notches, or teeth, on the lower side of the slider, are for setting the log, which is to be effected by the running back of the carriage, in a manner very similar to that adopted by Phineas Bennett. The mode of action is not exhibited sufficiently in detail, to instruct a workman, we cannot, therefore, speak with confidence respecting its originality.

---

14. For an improvement in the *Axles of wagons, carriages, &c.;* Spencer Coleman, Mount Pleasant, Spottsylvania county, Virginia, March 2.

These axles are called rolling axles, and from the description it appears that they are so denominated from the whole axle being allowed to revolve in boxes fixed on the bolster, or other suitable part, of the frame of the carriage; whether the wheels are also to revolve freely on the axles we are not told, but suppose that they are, otherwise there would be a difficulty in turning the carriage. There is not any claim made, and the patentee is in error in supposing, as he must, that the revolution of the whole axle is a novelty.

---

15. For a *machine for breaking dough, for making bread;* Daniel

D. Shackford, and Theodore Shackford, Westbrook, Cumberland county, Maine, March 2.

A circular platform, surrounded by a curb, or rim, converting it into a shallow tube, or trough, is made to revolve horizontally by suitable gearing; within this the dough to be broken is placed, and is operated on by a fluted frustrum of a cone which presses upon it; this frustrum has projecting axes which are suspended by a rope, or chain, from the upper part of the frame of the machine, allowing it to roll freely, and to adapt itself to the surface of the dough. The claim is to "the combination and arrangement of the foregoing machine for breaking dough."

Machines nearly identical with this have been used for washing clothes.

---

16. For *Rotary stove caps;* Maynard French, city of Albany, New York, March 2.

According to our understanding of the description of these rotary caps, or tops, of cooking stoves, they differ from those used in Stanley's well known rotary stove in being elevated three, or more inches above the upper fixed plate of the stove, by a circular rim, all around the cap, there being divisions, or descending partitions, on the under side of the cap, between the different openings for cooking utensils; this arrangement being substituted for the circular rim surrounding each opening on the upper side of Stanley's stove cap. The claim made is to "the elevation of the cap, or caps; the formation of the chambers by the various partitions on the under side of the cap or caps; the methods of conveying the smoke and heat from chamber to chamber; [by openings in the partitions,] and the adaptation and application of the said caps to stoves and furnaces, as above described." We see no essential difference between these caps, and those used by Stanley; nor any superior advantage to be derived from them.

---

17. For an improved machine for *Renovating and purifying Feathers;* John W. Post, and Ralph Collier, city of Baltimore, March 2.

Two plans of operation are here proposed; one of them is to put the feathers into a double cased vessel, provided with agitators to stir them up; they are to be heated by admitting steam from a boiler between the two cases, so that it may not come into contact with the feathers. The second plan is to dress the feathers without taking them out of the bed; an opening is to be made through the tick at one end, and a recurved metallic tube is to be inserted, through which steam and heated air are to be passed, the bed being occasionally shaken during the operation.

The claim is to "the apparatus as above constructed, and particularly the introduction of heat into beds, without taking out the feathers."

We do not believe that either of these plans will be so effectual as those in which moisture is allowed to come in contact with the feathers, and as respects that *particularly* claimed, we are convinced it will be productive of little, or no, benefit.

---

18. For a *Churn;* Amos Hanson, Windham, Cumberland county Maine, March 2.

The cream is to be put into a square box with a curved bottom, and to be agitated by means of revolving *ladle boards*, or dashers, which are to be

moved by a cog wheel and pinion. The claim is to "the gearing that is attached, and that operate said machine"!!

19. For an improvement in the *Printing Press;* John L. Kingsley, city of New York. First patented, April 22, 1835. Surrendered and reissued March 2nd, 1836.

We remarked upon this press as originally patented, at p. 328, vol. xvi. and noticed the defectiveness of the claims made; these are now in the following words: "What I claim as my own original invention in the machinery, is the universal joint of the ball in two sockets; the double joints of the connecting rod, roller, and standards; the manner of regulating power by the screw die and binding nut; and also to the lever, and its manner of connexion."

20. For a machinery for *Making Gauges for cabinet makers and joiners;* Morris M. Brainard, Great Barrington, Berkshire county, Massachusetts, March 4.

This machinery consists of a socket chisel for boring and mortising the heads; of a grooving drill, or cutter, for grooving the bar to receive the slide; of a sliding scraper for fitting the slide to the groove; of a burr saw for dressing the gauge bar; and of a revolving shaver for finishing the head of the gauge, and bringing it into proper shape. Most of these are revolving cutters used in the lathe, and adapted in form to the purpose for which they are intended, but not possessing any of that kind of novelty which would class them among inventions. They can hardly be said to be described, yet it would be easy to make similar tools by referring to the drawings, not from the special clearness of these, but from a familiarity with similar articles.

21. For a *Composition of Pitch;* Thomas H. Sherman, Scriba, Oswego county, New York, March 4.

To make this composition, twenty-five pounds of water lime, and eight and one-third pounds of salt are to be added to 100 pounds of common pitch; the lime is to be added first, then the salt, "and all the process is to be effected over a moderate fire. This gives a substance superior to common pitch, inasmuch as it is harder in the water, and wherever placed remains permanent."

The foregoing comprises the entire substance of the specification, in which there is not any claim made. We have known lime and salt added to tar, and the whole boiled together, which, we apprehend, produces a result the same with that of the foregoing recipe. This composition we have seen employed with good effect, for covering shingled roofs. Sparks falling upon it are not so likely to produce combustion as upon dry shingles.

22. For *Applying Plaster of Paris, in forming Walls, &c.;* John Flint, city of New York, and Clark Mills, Syracuse, Onondaga county, New York, March 4.

A main object of this patent is to secure the right of using "plaster to form walls to obstruct the influx of water in pits where reservoirs are to be built." After digging the pit, plaster is to be sifted, or poured, into the water which is contained in it, so as to cover the bottom to the thickness of four or five inches; a suitable curb is then to be inserted, leaving a space of two or three inches between it and the walls of the pit, which space is to

be filled with plaster; the curb, and any contained water, are then to be removed, and the plaster covered with a coating of hydraulic cement. Reservoirs in grounds free from water, and also above ground, are to be formed on similar principles, instructions for doing which are given in the specification.

The things claimed, are the use of calcined plaster, either alone or mixed with other materials, for making walls, or guards, to obstruct the influx of water, in places where such influx occurs; also the use of the like materials for forming other cisterns, to contain liquids.

Hydraulic cement, without the intervention of Plaster of Paris, has been used in a similar way, for the same purpose, and we cannot perceive the advantage of using both. With respect to the claim above made, we do not think it tenable, as it does not contain any new discovery, or mode of procedure, or point to any "new machine, art, manufacture, or composition of matter."

---

23. For an improvement in *Locks and Keys denominated the Lever Lock and Key;* Augustus Prutzmann, city of Philadelphia, March 4.

A report upon this lock will be found at page 180; it having been submitted to the Committee on Science and the Arts. We cannot do better than refer to their report, as any attempt at description, without several drawings, would give a very imperfect idea of the construction of the locks. We have not looked enough into it to form a satisfactory opinion of its relative merits.

---

24. For an improvement in *Rail Road Cars;* Frederick Davis and William Ashdown, Baltimore, Maryland, March 4.

This is said to be an improvement upon the plan patented by G. W. Cleaveland, on the 14th October, 1835, in which axles, divided in the middle, were employed in what was called a self-adjusting rail road car. The present patentees adopt the divided axle, each wheel turning independently, and being connected by a system of levers by which they propose to adapt the wheels to the curvature of the road, whatever that may be, and thus to prevent the vibrating, or zig zag, motion of the car, and preserve the flanch from contact with the rail. It so happens, however, that this vibratory motion is not caused by the curvature of the road, as it takes place as strikingly in the straight parts, and results from those perpetually recurring inequalities, which are unavoidable even on the best roads. The same defect attends the proposed plan as that which we have noticed in some others, namely, the fore and hind wheels are simultaneously acted upon; yet it must happen at the beginning and the end of every curve, that one pair of wheels will be on the curve, whilst the other pair is on the straight rails.

---

25. For a *Water Wheel;* Frederick Wingate, Augusta, Kennebec county, Maine, March 4.

The patentee intends to use this wheel, for "propelling mills, machinery of any kind, boats and vessels, by water power." Since obtaining his patent he has had time to try this wheel, and if he has done so, we are convinced that it is like many other things on trial, in the way of condemnation. The wheel is made in the manner of the common smoke-jack, consisting of a circular disk cut into six, or any other convenient number of, sections, by radial lines from the periphery towards the centre, and setting the sections

somewhat obliquely. Such wheels have been frequently tried, but not a second time, we apprehend, by the same person. They were essayed for propelling on the Hudson, by Gen. Stevenson, more than thirty years ago.

---

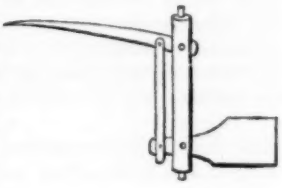
26. For an improvement in the *Bar-share Plough;* William P. Cannon, Monroe county, Tennessee, March 4.

CLAIM. "What I claim as my invention, and not previously known, in the above described plough, is the mortise, heel plate, and screw, on the horizontal bar, allowing the plough to be regulated in the depth by turning on the heel screw, instead of the eye or rachet, which rendered the plough stationary as to depth, unless through the alteration of the horses' hames. And in discovering the property, and first making of the mortice in the upright, or perpendicular bar, so as to fix the plough at any depth desirable by the movable rivet."

---

27. For an improvement in the *Rudders for Ships and Boats;* Samuel Kepner, Harrisburg, Dauphin county, Pennsylvania, March 4.

Ships need not to have been mentioned, as this rudder will never be applied to them; it has been contrived for canal boats, and may possibly answer a good purpose in such vessels. The sketch in the margin will give a correct idea of the thing proposed, which is so to construct the rudder that by depressing the tiller, it will be raised out of the water, in which case it may be made to operate like an oar, enabling the helmsman the more readily to govern the boat.



---

28. For a machine for *Turning Boots;* Pelatiah Stevens, Jr., Stoughton, Norfolk county, Massachusetts, March 4.

We described a machine for turning boots at p. 266, vol. xvii, which undoubtedly answered the purpose perfectly well. The plan now proposed bears a strong resemblance to the above; the present patentee, however, states that he contrived his and put it into operation, prior to July, 1833. We are apprehensive that this statement will not aid him in sustaining his patent, as a public use of it for two or three years would abstract something from its novelty.

---

29. For an improvement in the *Printing Press;* Hezekiah Camp, Trenton, Tuscarawas county, Ohio, March 4.

This is called a *flexible tympan press;* and it is so called because the tympan, with the sheet upon it, is drawn down under a press roller, to receive the impression. A claim is made to the manner of throwing this press roller in and out of gear; also to the flexible tympan, self-operating clamps, &c. The drawing is not sufficiently in detail to show the construction of the various parts; and the flexible tympan, which is broadly claimed, is not new.

---

30. For an improvement in the *Steam Engine;* Nathan Lockling, Sparta, Lexington county, New York, March 4.

This improvement is, to us, truly transcendental; or, in other words, we

are unable to follow out the intention of the inventor, even with the aid of a well executed drawing. The furnace is within the boiler, and it is proposed to return the smoke and the escape steam back again through the furnace. To effect this object the flue from the furnace enters a drum, or case, furnished with a revolving fan, which is to drive the smoke, &c. &c., through a tube leading down behind, and under, the boilers, through which it passes, opening under the burning fuel. We see nothing to prevent a perpetual circulation of the same products of combustion. Besides this smoke pipe from the furnace, a steam pipe enters the above named casing, directly from the boiler, and is, in the drawing, called an escape pipe, and steam will certainly escape though it, but not that which we usually understand by the term escape steam. "We give it up."

---

31. For *Cotton Gin Grates;* Edwin Keith, Bridgewater, county of Plymouth, Massachusetts, March 4.

This patent is taken for making the grates of cotton gins of chilled cast-iron. The method generally preferred, is to form the slots in the grates by laying plates of iron in the flasks when casting, which chills the parts where the saws operate; sometimes, however, the whole face of the grate is to be chilled. The claim is to "the making of grates for cotton gins of cast-iron, or other fusible metal suitable for the purpose, in sheets of two, or more, connected at the ends; and of chilling them either in the whole or in part, as described."

What "other fusible metal" is suitable for the purpose, we do not know; these words, it is true, will do no harm, but they are unmeaning, and intended to guard against some airy nothing.

---

32. For an improvement in the *Plough;* David Prouty, and John Mears, Boston, Massachusetts, March 4.

The claims made consist, "First, in the inclining the land side, so as to form an acute angle with the plane of the shear. Second, the placing the beam on a line parallel to the land side, within the body of the plough, and its centre nearly in the perpendicular of the centre of resistance. Third, the forming of the top of the standard for brace and draught." These points, it is stated, are not claimed separately, but in combination with each other. This plough, we are informed, has been highly approved by those farmers who have used it.

---

33. For an *Open Screw Wheel for propelling steam canal boats;* Aretus A. Wilder, Warsaw, Genessee county, New York, March 8.

The open screw wheel is to be made by floats upon a long shaft, forming an interrupted spiral; and this is claimed, with its application to the propelling of steam, canal, and other boats. If there were any novelty in this contrivance, we might descant upon its merits; but the patentee might find upon the shelves of the Patent Office, models of such wheels, long covered with the accumulating dust of years; much longer, we are fully convinced, than he will have them covered with water.

---

34. For a *Double Force Pump;* Levi Newton, Alexander, Genessee county, New York, March 8.

As usual, in patents for pumps, there is nothing new in that before us. Two chambers, or cylinders, are placed in a well, and a brake carrying

two piston rods, works the two pistons, and forces the water up through a common pipe.

---

35. For a *Splint for reducing fractures, called a sliding metallic Splint;* Enoch Thomas, New Athens, Morrison county, Ohio, March 8.

This splint is capable of being lengthened, or shortened, to adapt it to persons of different heights. We shall not attempt to describe the particular construction of any of its individual parts, as these do not constitute any part of the claim, although they are dilated upon in the specification. The claim is to "the combination, arrangement, and adaptation of the several parts of the splint, as described." A claim, which, like the splint itself, is calculated equally well to fit every subject.

---

36. For a *Smut machine;* Marcus P. Spafford, Gainsville, Genessee county, New York, March 8.

A conical body is to revolve within a conical case, as in many other smut machines. Both the exterior of the runner, and the interior of the case are to be first covered with sheet-iron, and then with sole leather, and through these coverings iron teeth are to be driven, cut nails answering the purpose. A fan-wheel is employed to blow through between the runner and the case, so as to drive the separated smut, &c., entirely away. A second fan-wheel below the machine is to effect the final cleaning. The patentee says that he "does not claim any part of the above construction other than the combination of the leather and sheet-iron, to retain the teeth, and in separating smut from grain, so as that they shall be immovable; and also the adaptation of the fan on the top of the cone to produce a current of air downwards through the teeth."

---

37. For *Leaching ashes, and making salts for Pearlash;* Elijah Williams, Erie, Erie county, Pennsylvania, March 8.

The instructions are to boil crude ashes in weak lye, or water, over a brisk fire, for about twenty minutes, the weak lye, or water, and the ashes, being in about equal proportions; this is to be let into the leach during the effervescence. The boiled ashes to be leached about eight inches in depth in the trough, boiling hot weak lye to be first used, and then boiling hot water. The lye is then to be boiled down in the usual manner.

The boiler should be made of sheet-iron, or copper, with a flat bottom, about three feet wide, and eight long, and twenty inches deep. The leaches to be of wood, with a flat bottom, and having a straw strainer, with a tube below for letting off the lye. Lye obtained by this process, and put through a lime strainer, will make good salts for melting. The claim is to "the boiling and leaching ashes, as above, without the use of lime, and making salts suitable for pearlash."

The above is the whole substance of the specification, if substance it have. To us, however, it is altogether obscure and indefinite.

---

38. For an improvement in the method of *Making Mould Candles;* Jefferson Dunlap, Village of New Holland, Lancaster county, Pennsylvania, March 8.

This is an apparatus for passing the wicks into the moulds, giving them the proper twist, and drawing the candles simultaneously from the moulds.

The machine appears to be well adapted to the purpose, but would require more than a verbal description. The whole arrangement is claimed.

---

39. For a *Brick making machine;* John Moffet, Buffaloe, Erie county, Pennsylvania, March 8.

In this machine the bricks are to be pressed into moulds by the passing over them a loaded car, or carriage, beneath which is a pressing roller, extending the length of the brick. The moulds are placed side by side, in any required number, so as to form a long trough of cells. Parallel to this celled trough, a second is placed at a suitable distance from it, and semicircular platforms are made at each end, so that the whole may form a continuous railway, admitting of the car to pass round and round. The moulds are to be filled with tempered clay, and the loaded car passed over them, which fills them and smooths the upper surface of the brick. The bottom of each mould is capable of being raised up so as to deliver the brick; and to effect this, from each of these bottoms the end of a lever projects, which is acted upon by a lifter on the hind wheel of the pressing car, in a way described in the specification. The claim is to "the adaptation of the car and rail road to the manufacture of bricks, as set forth; and to the manner of raising the bricks out of the moulds."

---

40. For the *Application of latent heat to cooking, &c.;* Peter Wenn, an alien, who has declared his intention to become a citizen of the United States. Philadelphia, March 8.

It is a little surprising that a patent should be obtained for a contrivance so manifestly useless in an economical point of view, as it is scarcely to be expected that any number of persons would purchase what few would receive as a gift, on the condition that they should use it. Passing over the false philosophy of boiling, &c. by latent heat, we proceed to state that the apparatus consists of a tin case, into the lower part of which quick lime is to be put, and upon this cold water is to be allowed to run, when, by the slacking of the lime, a sufficient degree of heat is to be disengaged to boil, stew, &c. &c. The claim "is to boil water, to bake, heat, cook, and to dry substances *by means of latent heat*, evolved in the before described apparatus, without the aid of fire, flame, or radiant heat; and the manner in which the apparatus is to be used as aforesaid."

As a mere article of curiosity the thing was well enough, though scarcely fit for a "nine days' wonder." The idea of laying in quick lime enough for fuel, of discharging and vending the slacked lime, with all their concomitants, is one which no person, possessing judgment upon the subject, would entertain for a moment; and we dare aver that the patentee would not continue to use his own apparatus in his family, were the lime sent to him gratis.

---

41. For a *Steam boiler;* Job Carr, Springborough, Warren county, Ohio, March 12.

This boiler is intended to "generate a sufficient quantity of steam for propelling any kind of machinery, without any danger of bursting or collapsing." And a claim is made to the construction of the reservoir and furnaces, or improved steam generator, and agreement of the combined parts." What is meant by the *agreement of the combined parts*, we cannot tell, as we find nothing new in the whole affair, either individually, or collectively. The only provision to prevent bursting is staybolting through

the boiler, and banding it with iron on the outside. The boiler itself is to be wagon-shaped, and the furnaces are to be within it. We collect from the description, that in order to generate steam enough, there must be fire enough, and water enough, but more than this we cannot discover.

---

42. For a *Washing machine;* Albion P. Arnold, Readfield, Kennebec county, Maine, March 12.

A double headed beater is made to vibrate in a trough in just the same way as in many other washing machines; and after giving the exact measures of the individual parts, the patentee claims "the fluted ends of the chest, the covering, the iron shaft and boxes, the steel spring and the lever on which it acts," to which might have been added "the washerwoman," if not previously claimed.

---

43. For a *Forcing pump;* William W. Lesuer, Venice, Cayuga county, New York, March 12.

This is a double, cylinder pump, arranged very much in the manner of the double pumps of an ordinary fire engine, with the disadvantage, however, of changing the direction of the water as frequently, and as abruptly as could well be done. A tube, or pipe, is to descend from the bottom of the box containing the cylinders, into the well, or other source of supply. A claim is made to "the tube on the under side of the box, as applied to this machine; the form of the box and the manner in which it is connected with the cylinders, and tube on the bottom of the box."

---

44. For a *Reaction water wheel;* Abraham Straub, Milton, Northumberland county, Pennsylvania, March 12.

This reaction wheel is to be in the form of a drum, or cylinder, like Wing's, and many others; but it is to have only two buckets, or floats, and two points of discharge; each bucket is to exceed a half circle, to allow their lapping over at the discharge orifices. The great point upon which the patentee depends, is the peculiar kind of curves which he gives to his two buckets, "the nature of which is such an involute as that its distance from its centre shall increase regularly and continually, thereby affording an uninterrupted discharge to the water, without any resistance being offered from the imperfections of shape found in those methods heretofore used." These involutes, or buckets, differ but little from segments of circles, and notwithstanding the applied mathematics of the patentee, we are fully convinced that were he to make his own wheel, and another in all respects similar, but with the buckets segments of circles, he would never, from their effects, discover the difference between the two. Every practical man knows to what a short distance theory will conduct him as a sure guide in hydraulic undertakings. We do not think it necessary to give the patentee's mode of describing his curve.

---

45. For a *Bed-bug destroyer;* Brittain Garrard, Maysville, Blount county, Tennessee.

Although three or four patents have been obtained for scalding bugs to death by steam, and although the kind of thing used for the purpose was well known prior to the obtaining of the first patent, it seems that there are yet some which have escaped destruction. The present patentee makes some change in the arrangement of his steam kettle, or boiler, rendering it

somewhat more complex, but we do not think more convenient, than heretofore. We shall not describe, as the patentee has not claimed, the alterations, or improvements, made in "the family safety scalding pot and steam engine."

---

46. For a *Mantle and Fender for fire places;* Elijah Skinner, Sandwich, Stafford county, New Hampshire. First patented April 19th, 1822. Patent surrendered and reissued March 12.

Neither the original, nor the renewed, specification presents any claim, and the principal, we believe the only, difference between them, is that the description in the latter is less full and clear than that of the former. The mantle is to be of sheet, or of cast-iron, and projects out like a shelf, having a facing descending at right angles from it. The fender is to be a thing of sheet-iron, bent thus ⌐; one edge of it going against the back of the chimney, and the other resting on the hearth, so as to cover the fuel and form a close stove. These affairs appear to be independent of each other, and ought, in this case, to have been the subject of two patents; we do not think, however, that the point is worth disputing.

---

47. For a *Cooking Stove;* John Liddle, Schoharie, county of Schoharie, New York, March 12.

A furnace is to be surrounded by a rectangular chamber, furnished with doors, and intended either for baking, or boiling, having openings in its lower side, over the fire, to receive boilers; when used for baking, these openings are to be closed by a cast-iron slide. Each end of this chamber forms a flat flue, communicating with flues surrounding an oven which surmounts the chamber first named. As we are left to discover the novelties in this contrivance, by the entire omission of a claim, we shall transfer the task to the reader.

---

48. For a *Cheap Lock;* Abel Conant, Lowell, Middlesex county, Massachusetts, March 12.

It so happens that this lock is not a lock, but merely a spring bolt, not a word being said about a key, or any contrivance for securing the bolt. The parts which are individually described, are, when put into their proper places, to form a mortise bolt, or fastening. The back part of the bolt, which occupies the interior of the box, is a quadrangular frame, which is forced back by means of a dog, or cam, in the usual way. A zigzag spring placed within the bolt, and bearing against the case of the tumbler and the front end of the hollow bolt, forces it forward. There are four individual claims, some of which, we apprehend, will not be sustainable. The first is to the cheap construction, which, as a result, may be very good, but as a claim is somewhat equivocal; the second, is to the transferring of a large portion of the champfer of the bolt to the catch, thus allowing the bolt to be reduced in thickness—which must certainly abridge the distance to which the bolt will throw out, and produce some inconvenience. The third is to the application of the zigzag spring within the hollow of the bolt, and the fourth, "to the use of cast, or wrought iron, knobs, or handles, in place of glass, wood, brass, or other metal." In this last particular, there is neither invention, nor discovery, but a mere change of materials; the validity of which, as a foundation of a claim, we must doubt.

49. For a *Cast-iron Fire place;* William Burgess, Middleborough, Plymouth county, Massachusetts, March 12.

An open, cast-iron, fire place is to have two, or more, ovens, at the back of it. The fire place must project out into the room, as the openings into the oven are at each end. There are also to be openings between, and at the back of the ovens, forming flues around which the heated air may pass. The claim is to "the application of the oven and cooking apparatus, to the common open fire place, or frame, as above described." The contrivance here claimed, resembles many others, and is not distinguished from them by any thing presented in the specification.

---

50. For *Machinery for making Cap Wire;* Melville Kelsey, city of New York, March 12.

The claim made in this machine is to "the principle of using two, or more, bobbins at the same time, upon the same spindles, thereby turning off the work much faster." The wire passes through a hollow mandrel, or spindle, upon one end of which are the bobbins and flyers. The description of the machine is not by any means clear, nor is the drawing a very descriptive one, but still, we believe, that by a competent workman, the machine might be made with their aid.

---

51. For an improvement in *Piano Fortes;* Henry Hartge, city of Baltimore, March 12.

The improvement here claimed, consists in making the tuning block of a piano forte, in part of wood, and in part of iron, in a way which we believe to be new. The wooden tuning block may be covered with an iron plate three-eighths of an inch in thickness, and the holes for the tuning pins be bored through the iron, and into the wood. The iron plate prevents the pins from being drawn out of perpendicular by the tension of the strings, whilst the pin has the advantage of being kept from turning by the elasticity of the wood. The claim is to "the metallic plate fastened to the tuning block, with holes for the tuning pins to pass through, furnishing additional security and permanency to such pins, and giving increased firmness to the tuning block, thereby aiding to keep the instrument in tune." We have no doubt of the goodness of this contrivance, or of its superiority to the devices which have preceded it in instruments where frames in part, or wholly, of iron, have been used to sustain the tension of the strings.

---

52. For an improvement in *Capstans for Ships or other vessels;* Andrew Morse, Jr., Boston, Suffolk county, Massachusetts, March 12.

The main body of this capstan revolves upon a hollow shaft firmly fixed in the deck of the vessel, and is turned by handspikes, in the usual way. It has a cap fixed upon a stout iron shaft, which iron shaft passes through the hollow shaft first mentioned, and extends to the lower side of the deck, and there carries a spur wheel, which mashes into another spur wheel upon a second shaft which passes up through the deck. The upper end of this second shaft has also a small spur wheel upon it, which mashes into a large wheel surrounding, and firmly fixed to, the lower end of the capstan. The small spur wheel upon the second shaft may be thrown out of gear at pleasure. The usual palls, to prevent back motion are, of course, employed. When the small spur wheel is thrown out of gear, and the windlasses are made to turn the main body of the capstan, it operates

without any aid from the gearing; but when the small wheel is in gear, and the handspikes are applied to the cap, the power is increased in a degree dependent upon the proportionate sizes of the train of wheels.

"The invention here claimed, and desired to be secured by letters patent, is the improvement of the ships' or vessels' capstan, so that increased power may be obtained at pleasure, as above described; with the arrangement, application, and adaptation of the several parts as herein set forth."

At page 394, Vol. xvi., a capstan is described, which operates upon the same principle with the foregoing, although not under precisely the same arrangement; this was patented in May, 1835. One very similar was patented in England, in February, 1827, see Newton's Journal, 2nd series, vol. ii, p. 66. Another still more like in arrangement, and precisely similar in effect, was patented by Capt. Phillips, in England, in 1819, see Newton's Journal, vol. ii, p. 1. Other examples might be offered, but these, it is supposed, will suffice. We are aware that the patentee may point out variations from these, which he may deem important; but we cannot perceive any substantial difference between his plan and that of Capt. Phillips, or any change which might not have been made by an ordinary workman who had no claim to inventive talent.

---

53. For a *Cotton Baling Press;* James C. Mitchell, Madison county, Mississippi, March 12.

In this press there are two followers, which, in pressing, are made to approach each other, by two shafts, each having a right handed screw cut on one end, and a left handed screw upon the other. The screws stand vertically, their upper ends revolving in collars in the cap of the press, and having spur wheels upon them above the cap. Their lower ends work in steps in the side of the press. The two followers have nuts let into them adapted to the screws. As this press is intended for baling cotton, there is a portion of each screw shaft, in the middle, which is left square, for nearly the thickness of a bale. A large spur wheel, on a vertical axis, turned by horse, or other, power, mashes into the wheels on the upper ends of the screw shafts, the right and left handed screws then cause the followers to approach, or recede, according to the direction in which they are turned.

The dimensions of the respective parts, and the appendages necessary for the packing of cotton, are sufficiently described in the specification. The construction of the press, with the exception of the wheels for working it, is claimed as entirely new.

---

54. For a *Compound Lever Tooth Extractor;* Moses P. Hanson, Bangor, Penobscot county, Maine, March 12.

This instrument is the same in principle with others which have been made for the same purpose. The tooth is to be seized by forceps, and to be drawn by causing a part of the instrument to rest upon the adjoining teeth, or gums, to operate as a fulcrum in drawing the tooth. Many teeth could not be drawn by means of such an instrument, and it is always objectionable, as the teeth upon which the fulcrum rests must be forced in with a power equal to that required for extracting the one to be drawn. We have now a similar instrument in our possession, and have seen many others. A good forceps, or key, correct judgment, a firm grip, and a strong wrist, require no patent, nor any improvement.

55. For *Drying paper by the application of Dry Heat;* Henry P. Howe, Shirley, Middlesex county, Massachusetts, March 12.

In the manufactories where cylinder paper is made, the sheet is dried by means of large, iron cylinders, into which steam is admitted through a hollow gudgeon; but the present patentee places a furnace within his cylinder, instead of using steam. We are by no means convinced, however, that the plan which he proposes is a real improvement, although we cannot offer any decided opinion on the subject, as the construction and management of the furnace, and some other points, are obscurely presented, and there is not any thing claimed.

---

56. For *Forge Backs for Blacksmiths;* Charles Richardson, Greenfield, Hillsborough county, New Hampshire, March 12.

There have been numerous patents for hollow, cast-iron, forge backs, many of them marked by very slight differences. We do not, in the one before us, see any thing worthy of particular notice. The patentee claims a "spiral plate of cast-iron, and the peculiar form and size of the swelled front, or convex part in the front part of the box." The spiral plate is a partition to cause the admitted air to circulate, and to become heated prior to its exit.

---

57. For an improved *Steam Boiler for generating Steam, to be used in the drying of paper;* John Ames, Springfield, Hampden county, Massachusetts, March 12. See specification.

---

58. For a *Machine for making Butts and Hinges;* Welcome Whitaker, Troy, New York, March 12.

We can afford but little more than the claims preferred by the patentee of this machine, which is intended to bend sheet metal round the joint wire, so as to form the knuckles of hinges. The description, which occupies several sheets of paper, might have been abridged by making duplicate drawings, and referring to them by letters, or figures, and whilst it would have lost in length, it would have gained in distinctness. The drawing is a well executed perspective, but showing only one view of the machine.

The claims are to "the manner and principle of placing, holding, and supporting the wire round which the tongues of butts, or hinges, are to be bent and formed into eyes, together with the manner of securing the hinge for that operation. The manner and principle of bending the tongue round the wire, either by allowing the ends of the dogs to slide upon their surface, or by causing them to roll and not slide. And also the above described machine, and every part of it, together with the manner, and principle of its construction and operation, as therein combined, and as constituting a whole, and as specially applied to the purposes of bending the tongues of the butts and hinges, and forming them into eyes."

---

59. For a *Detacher, for detaching horses from carriages, &c.;* Philip T. Share, city of Baltimore, March 18.

Numerous patents have been obtained, both here and in Europe, for detaching horses from carriages, in case of their running away; and many of them are sufficiently simple and efficient, but they have not been kept in use, nor are they likely to be so. We have no fault to find with the contrivance before us, nor any praise to bestow upon it, as it does no

appear to be either better or worse than several of its predecessors. Sailors are proverbially averse to cork jackets, and other life-preservers, and other classes act, more or less, from the same kind of impulse; there is a feeling adverse to the constantly guarding against evils which are contingent, and are believed to be remote. Where by one act, like insuring against fire, the precaution is in its nature durable, prudent men will resort to it, but, otherwise, rarely. The contrivance which has become our text, will soon be forgotten, and be succeeded by analogous inventions, destined to share the same fate.

---

60. For *the use of Gum Elastic in Corsets, Braces, &c.;* Ransom Warner, city of New York, March 18.

"I claim as my own invention, the application and introduction of gum elastic into the braces for the shoulders; for corsets; for men's and women's apparel; for suspenders; for the curved and distorted spine; for retaining the fracture of the collar bone in its place; and the applying of the gum elastic to the human system to supply artificial muscular power, so as to meet the antagonist muscle, or to supply strength to the weakened fellow muscles, in proportion to the necessity of the case, or as the contractile power may be required."

It is too late to claim the introduction of India rubber into braces, &c. &c., in the broad way in which it is claimed above, as it has been repeatedly used in webbing, and in other forms, for some of the purposes named. As regards several of these, we apprehend that its successful employment will baffle the skill of the patentee, although we should be glad to think otherwise.

(TO BE CONTINUED IN OUR NEXT.)

NOTE. We have not noticed one half of the patents for the month of March, the whole number being 133; the remainder will be given in our next; this, we are aware, will throw us another month in arrear with our notices, which we intend shall usually follow six months after that in which the patents are dated. The diminished number issued immediately after the passing of the new law, will enable us to overtake the business, without giving an undue length to the article containing our animadversions, as would have been the case had we included the whole for the month of March, in the present number.

SPECIFICATIONS OF AMERICAN PATENTS.

Specification of a patent for an improved Boiler for generating steam. Granted to JOHN AMES, *Springfield, Hampden county, Massachusetts, March 12th,* 1836.

To all whom it may concern, be it known, that I, John Ames, of Springfield, in the county of Hampden, and state of Massachusetts, have invented an improved boiler for the generating of steam, to be used in the drying of paper, and for other purposes, and do hereby declare that the following is a full and exact description thereof.

As this boiler is not intended to be used for steam of great elasticity, but is designed mainly, to produce it in large quantity, I intend, usually, to make it of cast-iron, although wrought-iron, or other metal, may be used if preferred. It may be made of various sizes, and in different shapes,

but for the sake of description, I will give the dimensions of one which I have tried, and found to answer well. It consists of a box four feet square, and two feet deep, the two sides being open, but furnished with flanches for the purpose of bolting on the two plates which are to form the two sides of the stove. Tubes, forming flues, in the manner of the boilers now in general use for locomotive engines, are to pass through these side plates. In the one alluded to, the plates are cast with six rows of holes, nine in each, and about two inches in diameter. The upper row of tubes must be sufficiently below the water line to insure their being constantly covered; and above the water there must, of course, be sufficient space to form a steam chamber, or reservoir.

When this boiler is set, the draught from the fire place below it passes through two rows of the tubes, is returned through the next two, and finally through the upper rows. The manner of forming the flue by divisions, extending from the brick work to the sides of the boiler, between the respective pairs of rows will be readily understood by reference to the drawing which accompanies this specification.

Fig. 1.

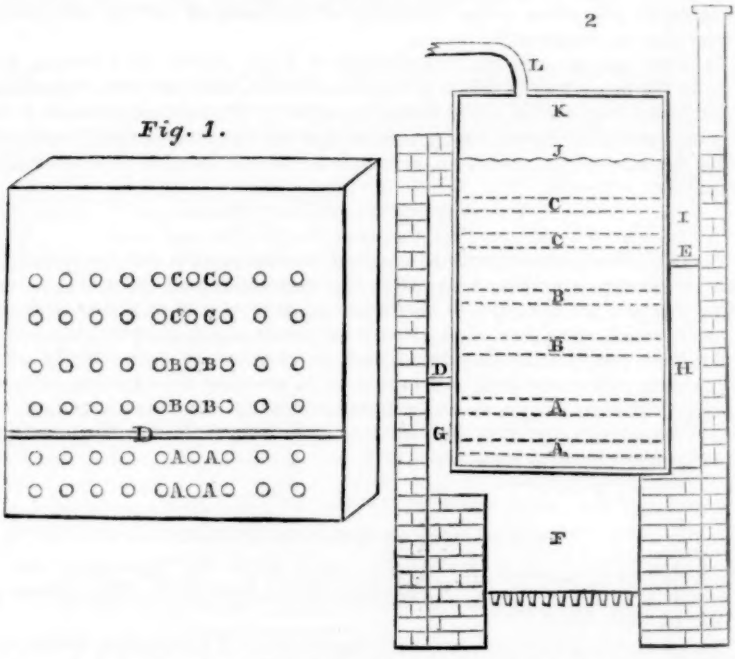


Fig. 1. is a side view of the boiler A A, B B, and C C, being the open ends of the tubes through which the heated air from the furnace is to pass, as will be shown more distinctly in fig. 2. D, is one of the ledges or partitions which project out from the boiler, occupying the space between it and the masonry in which the boiler is set, and causing the draught to enter the tubes A A, in order to its returning through those marked B B.

Fig. 2, is a vertical section of the boiler and furnace, cutting the boiler from front to back. A A, B B, and C C, are the double ranges of tubes,

as in fig. 1, represented by dotted lines. D and E, are partitions which direct the draught through the tubes in the following manner. Let F represent the furnace, and C a part of the flue into which the tubes A A, open, the draught being arrested by the partition D, will pass through A A, into the flue H, and being arrested by the partition E, will return through the tubes B B, then pass those marked C C, into the flue I, leading into a smoke pipe, or chimney; J, may represent the water line, K, the steam chamber, and L, the steam pipe.

Although I have mentioned a certain number of tubes, and have said that in the boiler which I have tried, the heated air is made to pass through the water three several times, it is manifest that the same operation may be repeated as frequently as it shall be found advantageous so to do. The number of tubes also, may be varied, and they may be placed in single rows, or otherwise, without altering the principle of action.

I have not mentioned the safety valves, cocks, or other general appendages to steam boilers, as in these I do not profess to have made any improvement; nor have I described any particular manner of securing the tubes, this being well known to engineers.

A boiler thus made, is recommended by its simplicity and economy, where it is desirable to generate a large quantity of steam under a moderate pressure, as for the purposes of heating and drying in various manufacturing processes. What I claim as my invention in it is the general combination and arrangement of the parts by which the draught from the fire is made to pass repeatedly through the water, as herein set forth, whether made in the exact form represented, or in any other which is substantially the same in its construction and operation.

JOHN AMES.

Progress of Physical Science.

On a new Force acting in the Formation of Organic Compounds. By M. BERZELIUS. *(Jahrbuch de Schumacher, for* 1836).

When new compounds are produced in inorganic nature as the result of the reaction of different bodies, it is in consequence of a mutual tendency of those bodies to satisfy the laws of their affinity in a more complete manner. First, the substances possessing dominant affinities enter into combination, and then those of feeble affinities which were excluded from the first combination. Before the year 1800, the existence, in these phenomena, of any other determining cause than the degree of affinity, heat, and, in some cases, light, was scarcely suspected. The influence of electricity was then discovered, and we soon saw ourselves in danger of confounding the electrical with the chemical relations of bodies, and of considering their affinities only as the manifestation of a strong electrical contrast, increased by light and heat. This system offered no other means of explaining the origin of a new compound, than by the supposition, that, by the approximation of bodies which are present, their electrical states become neutralized in a more perfect manner.

Setting off from these ideas, deduced from the effects which occur in inorganic nature, and studying the chemical re-actions presented by organized bodies, we perceived that in the organs of the latter, substances the

most various were elaborated, while the brute matter, whence they proceeded, consisted, in general, of but one liquid, circulating in vessels with more or less velocity. The vessels of the animal body, for example, pump blood from their origin without interruption, and nevertheless, secrete milk, bile, urine, &c. at their extremities, without admitting any other liquid capable of producing, by double affinity, any decomposition whatever. A fact here evidently occurs, which the study of inorganic nature was then unable to explain.

At this period M. Kirchhoff observed that starch dissolved in diluted acid, became converted, at a certain temperature, first into gum, and afterwards into grape-sugar. In conformity with the principles then received with regard to effects of this kind, an endeavour was made to ascertain what the acid had removed from the starch to reduce it into sugar; but no gas had been disengaged, the acid re-appearing by means of the alkalies in its primitive quantity, had not been combined, and the liquid contained only sugar in an equal, or even a larger, quantity than the starch which had been employed. The cause of this alteration was as problematical as that of the secretions in the organic body. M. Thénard then discovered the peroxide of hydrogen, a liquid, the elements of which are retained in combination by a very weak affinity. The acids do not produce any alteration in it; the alkalies, on the contrary, produce in it a tendency to decomposition, a species of fermentation, which reproduces water, in consequence of a disengagement of oxygen. But the most interesting circumstance, is, that the same effect takes place from the action of different solid bodies insoluble in water, organic as well as inorganic; for example, from the presence of peroxide of manganese, of silver, platinum, and also the fibrin of animal blood. The body which determines the decomposition does not undergo any alteration, it does not act as an element of a new compound, but by virtue of a peculiar force inherent in its mass, the existence of which, though unknown in its essence, is demonstrated by its effects. Shortly before M. Thénard, Sir H. Davy remarked another phænomenon, the analogy of which with the one just described, was not immediately perceived. He had proved that platinum, heated to a certain degree, and brought into contact with a mixture of the vapour of alcohol, or ether, and atmospheric air, possessed the power of determining and sustaining the combination of these bodies, while gold and silver were devoid of this property. Soon after, Mr. E. Davy discovered a preparation of platinum in a state of very great mechanical division, having, at ordinary temperatures, and after having been moistened with alcohol, the property of becoming incandescent by the combustion of alcohol, altogether in converting it by oxidation, into acetic acid. Then followed the discovery of Döbereiner, the most important of all. He proved that it is the property of spongy platinum to inflame, spontaneously, a current of hydrogen gas projected in the air; a phenomenon which the researches of M. M. Thénard and Dulong proved is produced by several other bodies, simple as well as compound: with this restriction, however, that while platinum, iridium, and some other platinal metals, act at temperatures below zero, other bodies, such as gold, and more especially silver, require a much higher temperature, and glass a heat even of above 300°. Thus what was at first considered as an exceptive mode of action, appeared to be a general property, though variously graduated, of all bodies, and from the application of which, advantage might be derived. We know, for example, that in the act of fermentation, in the conversion of sugar into alcohol and carbonic acid, the

action exercised by the insoluble substance named leaven, and which may be replaced, though with less success, by animal fibrin, albumen, and caseous substances, &c., cannot be explained by any chemical reaction of the affinities of the sugar and the leaven, and that no effect in inorganic nature approaches it so nearly as the action of platinum, silver, or fibrin in the decomposition of the peroxide of hydrogen into oxygen and water. It was natural here to suppose an analogous mode of action. The conversion of starch into sugar, by means of sulphuric acid, had not yet been co-ordinated with the preceding facts; the discovery, however, of diastase (announced in the Annual Report for 1833), a substance acting upon starch in an analogous manner, only with more energy, directed attention to this analogy, which was definitively proved by the ingenious researches of M. Mitscherlich upon the formation of ether. Among the numerous theories upon the formation of ethers, one, we know, makes the property of sulphuric acid to convert alcohol into ether, to depend upon its power of absorbing water, granting, that the alcohol, considered as a compound of one atom of etherine ($C^4 H^3$), and of two atoms of water, is reduced into ether, by ceding the half of its water to the acid. This theory, equally simple and ingenious, was in perfect agreement with our knowledge of the reaction of the affinities of bodies; it did not, however, explain why other bodies, not acids, having equal avidity for water, could not be employed in the same manner; why soda, potash, chloride of potassium, anhydrous lime, &c., if the transformation really depended only upon an affinity for water, did not equally produce ether. The researches of M. Mitscherlich proved that sulphuric acid, sufficiently diluted, and taken at such a temperature that the refrigeration produced by the addition of the alcohol, compensated for the heating which arose from the mixture, decomposed the alcohol into ether and water, which, because the temperature exceeded the temperature of ebullition of water, were both separated by distillation from the mass, and, as soon as the condensation was complete, presented a mixture of the same weight as that of the alcohol employed. The manner of performing this experiment, as well as the fact of the distillation of water conjointly with alcohol, was, it is true, known before M. Mitscherlich, but to him belongs the merit of having predicted its consequences. In fact, he proved that at this temperature, sulphuric acid must act upon alcohol by virtue of the same force which determines the action of the alkalies upon oxygenated water, since the water being entirely separated from the mixture, did not obey an affinity for the acid; whence he concluded, that the action of sulphuric acid and diastase upon starch, from which resulted the sugar, must be of the same nature.

It is then proved that many substances, simple or compound, solid or in solution, have the property of exercising an influence upon compound bodies essentially distinct from chemical affinity, an influence which consists in the production of a displacement, and a different arrangement, of their elements, without participating in it directly and necessarily, except in a few special cases. Certainly a force such as this, capable of producing chemical reactions in inorganic nature, as well as in organized bodies, though at present too little understood to be well explained, must exercise a more important function in nature than has hitherto been supposed. In defining it as a new force, I am far from wishing to deny that a certain connexion exists between it and the electro-chemical relations of matter. I am, on the contrary, strongly disposed to recognize in it a decided manifestation of these relations; nevertheless, till we have penetrated into the

real nature of this force, it will be more simple in our future researches to consider it as independent, and to give it, for facility of recognition, a name peculiar to itself. According to an etymology well known in chemistry, I shall consequently name it the CATALYTIC FORCE of bodies, and the decomposition which it determines *catalysis*, in the same manner as the separation of the elements of a compound, by means of the usual chemical affinities, is called *analysis*. This force may be defined to be *a power of bodies to bring into activity, by their simple presence, and without participating in it chemically, certain affinities, which at that temperature would remain inactive, so as to determine, in consequence of a new distribution of the elements of the compound, a new state of perfect chemical neutralization.* As this force acts in general in a manner analogous to heat, it may be inquired whether being variously graduated, sometimes by employing differently the same catalytic body, sometimes by the introduction of various catalytic bodies in the same liquid, it will cause, as is often observed in the action of heat at different temperatures, different catalytic products,—whether the catalytic force of a body can be exerted over a large number of compounds, or whether, as our experiments appear to indicate, only over certain bodies, to the exception of certain other bodies? But in the present state of our knowledge it is impossible to decide these questions, and many others that might be proposed upon the subject: their solution must depend on the results of future investigations. It is enough, for the present, to have shown, by a sufficient number of examples, the existence of this force, which, defined as it has been, diffuses a new light over the chemical reactions of organized bodies. We shall cite but one example. There is an accumulation of diastase around the eye of the potatoe, which is not found in the tubercle or in the developed germ; we perceive in this point a centre of catalytic action, at which the insoluble starch of the tubercle is converted into gum and sugar, and this part of the potatoe will become the secreting organ for the soluble substances, which are to form the juices of the growing germ. It is not probable that the action mentioned is the only one of its kind in vegetable life; on the contrary, it may be presumed, that in vegetables, as well as in the animal body, a thousand catalytic effects take place between the tissues and the liquids, whence results the great number of different chemical compounds, the production of which, from the same brute matter, which we call blood, or vegetable juices, cannot be explained by any other known cause.—*Bibliothèque Universelle, Nouv. Ser. Tome ii., p.* 376. A. T.

Rep. Pat. Invent. Aug.

Sixth Meeting of the British Association for the Advancement of Science.

The Annual Sessions of this Association were commenced by a meeting of the General Committee, at Bristol, on Saturday, August 20, and were continued throughout the following week. The arrangement was, that the Sections should meet at eleven o'clock every day during the week, and that the General meetings of the Association should be held at 8 o'clock on the evenings of Monday, Wednesday and Friday. The concluding meeting to take place on Saturday, at an hour fixed by the General Committee. Several public dinners were given, and an ordinary was provided daily, at the Horticultural rooms, for strangers, at 5*s.* per head. The number of members in attendance exceeded that of any previous meeting,

and amounted to about 1350. The business of the Association is conducted by several Committees and Sections, as follows:

Section A. *Mathematical and Physical Science.*
President, Rev. W. Whewell.

B. *Chemistry and Meteorology.*
President, Rev. Prof. Cumming.

C. *Geology and Geography.*
President, Rev. Dr. Buckland.

D. *Zoology and Botany.*
President, Prof. Henslow.

E. *Anatomy and Medicine.*
President, Dr. Roget.

F. *Statistics.*
President, Sir Charles Lemon, *Bart.*

G. *Mechanical Science.*
President, Davies Gilbert, Esq.

The President of the Association was the Marquis of Landsdowne, who was prevented from attending by the illness of his eldest son, the Earl of Kerry, who died during the week of the Sessions. The chair was taken by the Marquis of Northampton, one of the Vice Presidents.

The business of the week appears not to have been excelled, in point of interest, by that of any prior meeting of the Association. Most of the British Savans whose names are well known throughout the scientific world, were present, except that among those whose names now occur to us, and which we do not find in the list of attendants, are Faraday, Airy, and some others. Among the learned strangers, were Baron Dupin of the French Institute, and Dr. Hare of Philadelphia. The latter was elected one of the Committee of Section B. His several communications were evidently received with most respectful attention, and at the public dinner, where nearly 500 persons were present, we find him on the right of the chair next to Prof. Whewell.

"The interest excited throughout the week, (observes the correspondent of the London Athenæum,) cannot be conceived by those who were not present. The mass of interesting matter brought forward was quite unexpected. Prof. Sedgwick said that the present meeting was worth all previous ones put together—that now the British Association was really advancing Science, all the branches of which were becoming more and more connected with each other. The new views of Physical Science brought forward at the Geological Section, were the most important advances yet made in Geology. This would gradually be numbered among those branches of knowledge under the dominion of mathematical laws, and be eventually placed in the same ranks with her kindred sister Astronomy."

The sum devoted to scientific enquiries during the ensuing year exceeds £2700! The next meeting of the Association is to be held at Liverpool, rather later in the year than the present; the day to be fixed by the General Committee.

The office bearers chosen for the meeting in 1837, are the Earl of Burlington, President; Dr. Dalton, Sir Philip Egerton, Rev. E. G. Stanley, Vice Presidents; Dr. Charles Henry, Mr. Parker, Secretaries.

Our extracts from the published accounts of the various matters brought forward in the different Sections must, necessarily, be limited to a few of those that appear to possess the greatest novelty and interest.

Change in the Chemical character of Minerals induced by Galvanism. By R. W. Fox. This communication was from a gentleman long known in connexion with Science, and largely connected with the mining districts of Cornwall. Nothing which occurred at the meeting appears to have produced a higher interest than this communication, and the one which immediately followed.

Mr. Fox exhibited the extraordinary experiment of the change of yellow into the grey sulphuret of copper. In a trough a mass of clay was placed so as to divide it into two portions, in one of which was sulphate of copper in solution, in the other dilute sulphuric acid. On the electric communication being made by placing the yellow sulphuret in the solution, and a piece of zinc in the acid, the change of the sulphuret took place, and crystals of native copper were also formed upon it.

Mr. Fox then made some remarks upon the electro-magnetism of veins. It was plain that when a rock contained mineral matter, the rock and its contents must be in different electrical states, so that electricity must exist in very great activity in the interior of the globe. He referred to his experiments recorded in the Transactions of the Geological Society. He alluded to the north-east and south-west directions of the Cornish veins, and he had ascertained that there are Voltaic currents perpendicular to the magnetic meridian. Tin is found to exist in veins, or in different parts of the same vein; and, in experimenting, he found that metallic tin went to the positive, and oxide of tin to the negative pole of the apparatus. He was also struck with a kind of polarization in the disposition of the matter of veins; thus, iron and copper presented distinct relations to each other; the grey sulphuret of copper was uniformly found above the yellow; the quartz of N. and S. veins were striated, that of E. and W. veins not so. The phenomena of the intersection of veins were also spoken of; the old supposition, that one vein must be older than the other, need not be resorted to in all cases, as it could be proved that crossing veins were often of simultaneous origin.—Dr. Buckland pointed out Mr. Fox's experiment as an illustration of the simplicity of the means which nature had adopted in her most subtle operations, and expressed his hope that this new application of electro-chemistry to geology, would furnish a series of results of paramount importance. Indeed, one of the great benefits conferred by the British Association on science, was the bringing forward individuals who had devoted themselves in private, to scientific investigation and experiment, which often, as in the case of Mr. Fox, opened the portals that led to new views of nature and her operations. He had now to introduce to the notice of the Section another gentleman, who had for many years, in private seclusion, occupied himself in experiments of a novel and extraordinary character, and also making use of apparatus of the most simple description. He then presented to the notice of the meeting, Mr. Cross, who would give a verbal account of his most singular proceedings.

Artificial Crystals and Minerals. A. Cross, Esq. of Bloomfield, Somerset, then came forward and stated that he came to Bristol to be a listener only, and with no idea that he should be called upon to address a Section. He was no geologist, and but in a moderate degree a mineralogist. But, being early impressed with the notion that it would be desirable to produce, if possible, a long continued, undiminished electrical action, he had set himself to work, and after many trials he had constructed an apparatus, which had for no less than an *entire year* retained its electric energy, and

this by the agency of pure water only. He had also conceived, that it being by long continued processes that nature produced most of the effects which we observe, it might be possible to form substances similar to what she affords, by adopting a mode like hers. His attention had been directed to a cavern in the Quantock Hills, in which he had observed calcareous spar incrusted on limestone, and arragonite on clay slate: these minerals had evidently been formed by the water which percolated the rocks. Some of this water he brought to his house, and presented it to the action of his Voltaic apparatus; for nine days he anxiously watched for a result, but no visible one offering, he had almost given up the experiment, when on the tenth day, to his great delight, he succeeded in procuring minerals the same as in the cavern. He was thus encouraged to prosecute further experiments; and, in the course of his investigations, he found that light was unfavourable to the perfection of crystals, he being enabled, in a much shorter period, and with much weaker electric power, to produce them in the dark. He formed several crystals of metallic minerals, but his most successful experiment was the production of quartz from fluo-silicic acid, and his inspection of what has been perhaps never before observed by mortal eye, the process of crystalline developement from the beginning. He had traced a quartz crystal, first, as a hexagon marked upon the matrix—then lines radiated from its centre —then parallel lines were formed parallel to its sides—it increased in thickness, but, owing to some disturbance of the operation, the process of forming a single perfect crystal was not completed, for a second crystal grew up and intersected it, offering an additional confirmation of the resemblance of Mr. Cross's process to that of nature, where this penetration of crystals into each other is every where to be observed.

It would be extending this report too far to relate all that Mr. Cross communicated to the Section regarding the details of his experiments; but it is impossible to convey an idea of the enthusiasm with which his statement was received by the crowded assembly present. There appeared to be a real *electrical* effect produced upon them; they seemed as if the interior recesses of Nature had been of a sudden laid open to them, and her processes, which had been conceived as past all mortal ken, submitted to their inspection. Mr. Cross was often interrupted during his address with loud peals of applause, which lasted for several minutes after he sat down.—Mr. Conybeare said, that he found himself so excited with the intelligence, that he should not submit his observations on the South Wales Coal Basin; he considered any communication he could bring forward totally eclipsed in interest by the overpowering intelligence brought by Mr. Cross. Upon that gentleman Mr. Sedgwick passed also a highly eloquent eulogium. Professor Phillips stated, that he had now hopes of realizing his fondest dreams of geology. He had long conceived that Nature must have some means of conveying solid matter through solid matter, and that this was now proved by Mr. Cross, whose discoveries were of such importance, that had the British Association been of no other service than in bringing them to light, they alone were worth all the pains it had taken for the advancement of science, and it was its particular business to have experiments like his set on foot, and prosecuted for many years to come.

It was mentioned to the Section on the following day, that although no doubt could be entertained of the independence and originality of Mr. Cross's experiments, yet that he had been anticipated in the artificial production of many of the crystalized bodies which he had formed, by M. Becquerel and some other French Chemists.

Improvements on the Electrical Apparatus for Dancing-Images.

When the plates are not of considerable size the images leap off, and if very large the view is obstructed. To obviate these difficulties, plates of glass are recommended by W. Ettrick, with bands of tin foil pasted in corresponding positions on each side. In fig. 1, $a'\ b'\ c'$, and $x\ y\ z$, and $a'\ a$, represent

Fig. 2.

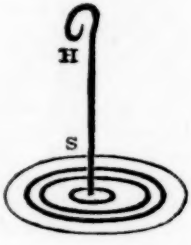
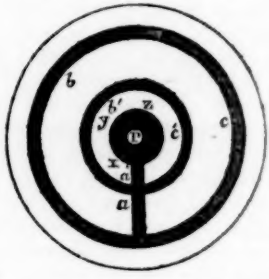


Fig. 1.



pieces of tinfoil pasted on each side of the glass; a hole P being cut in the centre of the glass to pass the tinfoil $a\ a'$ through, and thereby connect the metallic circular slips. In fig. 2, the rod and crook S H represents the suspending wire, which is screwed into a circular flat piece of brass, upon which the glass plate lies. The slips or rings of tinfoil do not come close to the edge of the glass, which greatly assists in keeping the figures upon the plates, because they will generally touch the tinfoil, as being more charged than the glass. If a similar glass plate be used for the lower plate, it would be a further improvement. Lond. Mech. Mag.

Progress of Practical and Theoretical Mechanics and Chemistry.

Method of separating small quantities of Arsenic from substances with which it may have been mixed. By Mr. James Marsh, *of the Royal Arsenal, Woolwich.**

Notwithstanding the improved methods that have of late been invented of detecting the presence of small quantities of arsenic in the food, in the contents of the stomach, and mixed with various other animal and vegetable matters, a process was still wanting for separating it expeditiously and commodiously, and presenting it in a pure unequivocal form for examination by the appropriate tests. Such a process should be capable of detecting arsenic not only in its usual state of white arsenic or arsenious acid, but likewise that of arsenic acid, and of all the compound salts formed by the union of either of these acids with alkaline substances. It ought, also, to exhibit the arsenic in its reguline or metallic state, free from the ambiguity which is sometimes caused by the use of carbonaceous reducing fluxes. It appeared to me, that these objects might be attained by presenting to the arsenic hydrogen gas in its nascent state: the first action of which would be to deoxygenate the arsenic; and the next, to combine with the arsenic, thus deoxygenated, into the well known gas called arsenuretted hydrogen. Being thus brought to the gaseous state, the arsenic would spontaneously (so to speak) separate itself from the liquor in which it was before dissolved,

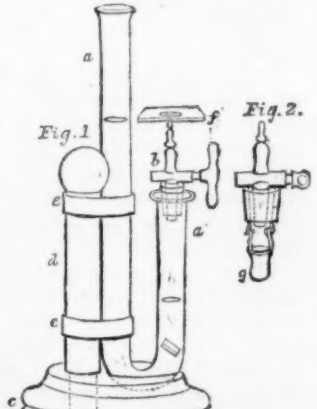
* Received by the Franklin Institute in a pamphlet from London.

and might be collected for examination by means of any common gas apparatus; thus avoiding the trouble, difficulty, and ambiguity of clarification and other processes whereby liquors, suspected of containing arsenic, are prepared for the exhibition of the usual tests, or of evaporation and deflagration which are sometimes had recourse to, in order to separate the arsenic from the organic substances with which it may have been mixed.

I had the satisfaction of finding, on trial, that my anticipations were realized; and that I was thus able, not only to separate very minute quantities of arsenic from gruel, soup, porter, coffee, and other alimentary liquors, but that, by continuing the process a sufficient length of time, I could eliminate the whole of the arsenic in the state of arsenuretted hydrogen, either pure, or at most, only mixed with an excess of hydrogen.

If this gas be set fire to as it issues from the end of a jet of fine bore into the common air, the hydrogen, as the more combustible ingredient, will burn first, and will produce aqueous vapour, while the arsenic will be deposited either in the metallic state, or in that of arsenious acid, according as it is exposed partially or freely to the air. The former condition is brought about by holding a piece of cold window glass opposite to and in contact with the flame, when a thin metallic film will be immediately deposited on its surface; and the latter, by receiving the flame within a glass tube open at both ends, which, in half a minute, will be found to be dimmed by a white pulverulent sublimate of arsenious acid. By directing the flame obliquely within side of the tube, it strikes against the glass and deposites the arsenic partly in the metallic state. In this case, if the tube, while still warm, be held to the nose, that peculiar odour, somewhat resembling garlic, which is one of the characteristic tests of arsenic, will be perceived. Arsenuretted hydrogen itself has precisely the same odour, but considerable caution should be used in smelling to it, as every cubic inch contains about a quarter of a grain of arsenic.

The requisite apparatus is as simple as possible, being a glass tube open at both ends, and about three quarters of an inch in its internal diameter. It is bent into the form of a syphon (*a'a*, fig. 1), the shorter leg being about five inches, and the longer about eight inches in length. A stop-cock *b*, ending in a jet of fine bore, passes tightly through a hole made in the axis of a soft and sound cork, which fits air-tight into the opening of the lower bend of the tube, and may be further secured, if requisite, by a little common turpentine lute. To fix the apparatus, when in use, in an upright position, a hole is made in the wooden block *c*, for the reception of the lower part of the pillar *d*, and a groove is cut in the top of the same block to receive the bend of the tube *a a*. Two elastic slips *e e*, cut from the neck of a common bottle of India rubber, keep the tube firm in its place.



The matter to be submitted to examination, and supposed to contain arsenic, if not in the fluid state, such as pastry, pudding, or bread, &c., must be boiled with two or three fluid ounces of clean water, for a sufficient length of time.

The mixture so obtained must then be thrown on a filter to separate the more solid parts: thick soup, or the contents of the stomach, may be diluted with water and also filtered; but water-gruel, wine, spirits, or any kind of malt liquor and such like, or tea, coffee, cocoa, &c., can be operated on without any previous process.

When the apparatus is to be used, a bit of glass rod, about an inch long, is to be dropped into the shorter leg, and this is to be followed by a piece of clean sheet zinc, about an inch and a half long and half an inch wide, bent double, so that it will run down the tube till it is stopped by the piece of glass rod first put in. The stop-cock and jet are now to be inserted, and the handle is to be turned so as to leave the cock open. The fluid to be examined, having been previously mixed with from a drachm and a half to three drachms of dilute sulphuric acid (1 acid and 7 water,) is to be poured into the long leg, till it stands in the short one about a quarter of an inch below the bottom of the cork. Bubbles of gas will soon be seen to rise from the zinc, which are pure hydrogen if no arsenic be present; but, if the liquor holds arsenic in any form of solution, the gas will be arsenuretted hydrogen. The first portions are to be allowed to escape, in order that they may carry with them the small quantity of common air left in the apparatus; after which the cock is to be closed, and the gas will be found to accumulate in the shorter leg, driving the fluid up the longer one, till the liquor has descended in the short leg below the piece of zinc, when all further production of gas will cease. There is thus obtained a portion of gas subject to the pressure of a column of fluid of from seven to eight inches high: when, therefore, the stop-cock is opened, the gas will be propelled with some force through the jet, and, on igniting it as it issues (which must be done quickly by an assistant,) and then holding horizontally a piece of crown or window class (*f*, fig. 1) over it, in such a manner as to retard slightly the combustion, the arsenic (if any be present) will be found deposited in the metallic state on the glass; the oxygen of the atmosphere being employed in oxydizing the hydrogen only during the process. If no arsenic be present, then the jet of the flame as it issues has a very different appearance; and, although the glass becomes dulled in the first instance by the deposition of the newly formed water, yet such is the heat produced, that in a few seconds it becomes perfectly clear, and frequently flies to pieces.

If the object be to obtain the arsenic in the form of arsenious acid, or white arsenic, then a glass tube, from a quarter to half an inch in diameter (or according to the size of the jet of flame,) and eight or ten inches in length, is to be held vertically over the burning jet of gas, in such a manner that the gas may undergo perfect combustion, and that the arsenic combined with it may become sufficiently oxydized; the tube will thus, with proper care, become lined with arsenious acid in proportion to the quantity originally contained in the mixture.

When the glass tube is held at an angle of about forty-five degrees over the jet of flame, three very good indications of the presence of arsenic may be obtained at one operation; viz. metallic arsenic will be found deposited in the tube at the part nearest where the flame impinges,—white arsenic or arsenious acid at a short distance from it,—and the garlic smell can be readily detected at either end of the tube in which the experiment has been made.

As the gas produced during the operation is consumed, the acid mixture falls into the short limb of the tube, and is thus again brought into contact with the

zinc, in consequence of which a fresh supply is soon obtained. This gas, if submitted to either of the processes before described, will give fresh indications of the presence of the arsenic which the mixture may have originally contained; and it may be easily perceived that the process will be repeated as often as may be required, at the will of the operator, till no further proofs can be obtained.

When certain mixed or compound liquors are operated on in this apparatus, a great quantity of froth is thrown up into the tube, which may cause a little embarrassment by choking the jet. I have found this effect to take place most with the contents of the stomach, with wine, porter, tea, coffee, or soup, and, indeed, with all mucilaginous and albuminous mixtures. The means I adopt to prevent this effect from taking place, or, at least, for checking it in a great measure, is to grease or oil the interior of the short limb of the apparatus before introducing the substance to be examined, or to put a few drops of alcohol or sweet oil on its surface previously to introducing the stop-cock and its appendages. I have, however, found, if the tube be ever so full of froth in the first instance, that, in an hour or two, if left to itself, the bubbles burst, and the interior of the tube becomes clear without at all effecting the results.

In cases where only a small quantity of the matter to be examined can be obtained, I have found a great convenience in using the small glass bucket, (*g*, fig. 2). Under such circumstances, the bent glass tube may be filled up to within an inch of the short end with common water, so as to allow room for the glass bucket, which must be attached to the cork, &c. by means of a little platina wire; a bit or two of zinc is to be dropped into the bucket, with a small portion of the matter to be examined, and three or four drops of diluted sulphuric acid; (acid 2, water 14,) and the whole is then to be introduced into the mouth of the short limb of the tube. The production of gas under this arrangement is much slower, and, of course, requires more time to fill the tube, than in the former case, but the mode of operating is precisely the same. Indeed, it is of great advantage, when the quantity of arsenic present is very minute, not to allow the hydrogen to be evolved too quickly, in order to give it time to take up the arsenic.

A slender glass funnel will be found of service when as much as a table-spoonful, or even a tea-spoonful of matter, can be obtained for examination. In this case, the tube is to be partly filled with common water, leaving a sufficient space for the substance to be examined; a piece of zinc is to be suspended from the cork by a thread or wire, so as hang in the axis of the tube; and the fluid to be operated on, having previously been mixed with dilute sulphuric acid, is then to be poured through the funnel carefully, so as to surround the zinc, avoiding, as far as possible, to mix it with the water below, and the stop-cock and its appendages are to be replaced in the mouth of the tube; the production of the gas then goes on as before stated, and the mode of manipulating with it, is exactly the same as described in the foregoing part of this paper.

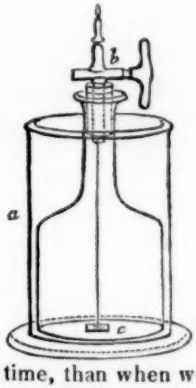
It will be necessary for me, in this place, to explain the methods I employ after each operation, to determine the integrity of the instrument, so as to satisfy myself that no arsenic remains adhering to the inside of the tube, or to the cork and its appendages, before I employ it for another operation.

After washing the apparatus with clean water, a piece of zinc may be dropped in, and the tube filled to within half an inch of the top of the short limb; two drachms of diluted sulphuric acid are then to be poured in, and the stop-cock and cork secured in its place; hydrogen gas will in this case,

as before, be liberated, and fill the tube. If the gas as it issues from the jet be then inflamed, and a piece of window glass held over it as before described, and any arsenic remains, it will be rendered evident by being deposited on the glass; if so, this operation must be repeated till the glass remains perfectly clean, after having been exposed to the action of the gas.

When I have had an opportunity of working with so large a quantity of mixture as from two to four pints, (imperial measure) I have employed the instrument (fig. 3), which is, indeed, but a slight modification of one of the instantaneous light apparatuses, now so well known and used for obtaining fire by the aid of a stream of hydrogen gas thrown on spongy platinum. It will, therefore, be of importance only for me to describe the alteration which I make when I employ it for the purpose of detecting arsenic. In the first place, I must observe, that the outer vessel *a*, which I use, holds full four pints, and that the jet of the stop-cock is vertical, and its orifice is twice or three times larger than in the instrument as generally made for sale, and also that there is a thread or wire attached to the cork of the stop-cock *b*, for suspending a piece of zinc *c*, within the bell glass.

Fig. 3.



With an intrument of this description, I have operated on one grain of arsenic in twenty-eight thousand grains of water (or four imperial pints), and have obtained therefrom, upwards of one hundred distinct metallic arsenical crusts.

Similar results have been obtained with perfect success from three pints of very thick soup, the same quantity of port wine, porter, gruel, tea, coffee, &c. &c.

It must, however, be understood, that the process, was allowed to proceed but slowly, and that it required several days before the mixture used ceased to give indication of the presence of arsenic, and also, a much larger portion of zinc and sulphuric acid was employed from time to time, than when working with the small bent tube apparatus, in consequence of the large quantity of matter operated on under this arrangement.

With the small apparatus, I have obtained distinct metallic crusts, when operating on so small a quantity as one drop of Fowler's solution of arsenic, which only contains one-120th part of a grain.

The presence of arsenic in artificial orpiment and realgar, in Scheele's green, and in the sulphuret of antimony, may be readily shown by this process, when not more than half a grain of any of those compounds is employed.

In conclusion, I beg to remark, that although the instruments I have now finished describing, are the form I prefer to all that I have employed, yet it must be perfectly evident to any one, that many very simple arrangements might be contrived. Indeed, I may say unequivocally, that there is no town or village in which sulphuric acid and zinc can be obtained, but every house would furnish to the ingenious experimentalist ample means for his purpose; for, a two-ounce phial, with a cork and piece of tobacco-pipe, or a bladder, with the same arrangement fixed to its mouth, might, in cases of extreme necessity, be employed with success, as I have repeatedly done for this purpose.

The only ambiguity that can possibly arise in the mode of operating above described, arises from the circumstance, that some samples of the zinc of commerce themselves contain arsenic; and such, when acted on by dilate sulphuric acid gave out arsenuretted hydrogen. It is, therefore, necessary for the operator to be certain of the purity of the zinc which he employs, and this is easily done by putting a bit of it into the apparatus, with only some dilute sulpuric acid; the gas thus obtained is to be set fire to as it issues from the jet; and if no metallic film is deposited on the bit of flat glass, and no white sublimate within the open tube, the zinc may be regarded as in a fit state for use.

Method of determining the value of Black Oxide of Manganese for manufacturing purposes. By THOMAS THOMSON, *M. D., F. R. S., L. and E. Regius Professor of Chemistry in the University of Glasgow.*

The manganese to be tested must be reduced to a fine powder, or brought into the state in which it is used by the manufacturers of bleaching-powder. To determine its value, proceed in the following manner:

Into a balanced Florence flask put 600 grains of water, and 75 grains of crystals of oxalic acid. Then add 50 grains of the manganese to be tested; and, as quickly as possible, pour into the flask from 150 to 200 grains of concentrated sulphuric acid. This is best done by having a given weight of sulphuric acid, say 210 grains, previously weighed out in a glass measure, counterpoised on one of the scales of a balance. You pour into the flask as much of the sulphuric acid as you can conveniently. Then, putting the measure again into the scale, you determine exactly how much has been put in.

A lively effervescence takes place, and carbonic acid gas is disengaged in abundance. Cover the mouth of the flask with paper, and leave it for twenty-four hours; then weigh it again. The loss of weight which the flask has sustained is exactly equal to the quantity of *binoxide* of manganese in the powder examined. Thus, let the loss of weight be 34 grains; the quantity of binoxide of manganese in the 50 grains of the powder which was tested will be 34 grains; or it will contain 68 per cent. of pure binoxide of manganese, and 32 per cent. of impurity.

To understand what takes place, it is necessary to recollect that oxalic acid is composed of

2 atoms carbon	1.5
3 atoms oxygen	3
	4.5

and that of binoxide of manganese is composed of

1 atom manganese	3.5
2 atoms oxygen	2
	5.5

The oxalic acid acts on the binoxide by abstracting one-half of its oxygen, which converts it into carbonic acid; hence the effervescence. 55 grains of pure binoxide of manganese would give out 10 grains of oxygen, which would convert 45 grains of oxalic acid into 55 grains of carbonic acid; which escaping, indicate, by the loss of weight, the quantity of carbonic acid formed. Now, it happens that the weight of the carbonic acid formed is exactly equal to the quantity of binoxide of manganese which

gives out its oxygen to the oxalic acid. Hence the reason of the accuracy of the test.

In other words, an integral particle of binoxide of manganese, which weighs 5.5, gives out 1 atom of oxygen. This atom of oxygen combines with an integrant particle of oxalic acid, weighing 4.5, and converts it into two integrant particles of carbonic acid, which both together weigh 5.5. As this carbonic acid escapes, the loss of weight must be just equal to the quantity of binoxide of manganese in the powder subjected to experiment.

In practice, I find that a small quantity of the binoxide of manganese sometimes escapes the action of the oxalic acid, being probably screened by the great quantity of impurity with which it is mixed. But the deficiency of carbonic acid occasioned by this, is about made up by the moisture which the carbonic acid gas carries off along with it. This renders the error, in general, trifling.

It will be proper to subjoin an example or two of the method of proceeding, to enable the reader to judge of the goodness of this test, and its value to the manufacturer.

The black oxide of manganese employed was subjected to analysis, and found composed of

Binoxide of manganese	68.49
Peroxide of iron	11.85
Water	5.68
Earthy matter	13.98
	100.00

Experiment 1.

Put into the flask—	Water	599 grains.
	Oxalic acid	75
	Black oxide	50
	Sulphuric acid	184
Total		908

Loss of weight 32.5 grains. It ought to have been 34.245 grains. Error 1.745 grains.

Experiment 2.

Put into the flask—	Water	600 grains.
	Oxalic acid	75
	Black oxide	50
	Sulphuric acid	154
Total		879

Loss of weight 34.5 grains. It ought to have been 34.245 grains. Here the error is in excess, and amounts 0.255 grains.

Experiment 3.

Put into the flask—	Water	600 grains.
	Oxalic acid	75
	Black oxide	50
	Sulphuric acid	154.1
Total		879.1

Loss of weight 35 grains. Here also the error was in excess, and amounted to 0.755 grains.

Let us take the mean of these three experiments:

Loss of weight by	1st	32.5 grains.
	2nd	34.5
	3rd	35.0
		3)102
Mean		34 grains.

Here the error amounts to 0.245 grains, which is considerably less than one per cent. If, therefore, three trials be made, the error will be under 1 per cent.; so that the method is quite sufficient to indicate very nearly the quantity of binoxide of manganese in any ore. Now, it is the binoxide of manganese alone that is useful to the manufacturer; the sesqui-oxide and red oxide availing very little in the preparation of chlorine, for which almost alone the ore is used by manufactures.

I tried various other proportions of the ingredients, but found the preceding the best. I tried, also, the effect of rubbing up in a mortar the oxalic acid and black oxide. But the error is least when the oxalic acid is merely poured into the water, and the black oxide added before the acid is dissolved. Unless the sulphuric acid be added last, we cannot be sure of our weights.

Rec. Gen. Sc. June, 1836.

Evolution of Light during Crystalization. A dull light sometimes appears while a solution is in the process of crystalizing, but the phenomenon has been considered as accidental and never exhibited at will, or as an experiment. A method has been pointed out by Henri Rose of Berlin, by which this light can be produced at any time.

Put two or three drams of arsenious acid, of a vitreous aspect, in a clear glass matrass, and sprinkle it with an ounce and a half of non fuming, common hydrochloric acid, and half an ounce of water. Heat it to ebullition, let it boil ten or fifteen minutes, then cool it as slowly as possible by gradually lowering the lamp or removing the heat. If the crystals begin to form in a dark place, the creation is accompanied with a vivid light, and the formation of each little crystal is attended with a spark. If the vessel be shaken a great number of crystals are suddenly formed, and as many sparks produced. If a larger proportionate quantity of the materials be taken, such as an ounce or two of arsenious acid, the light, at a favourable moment, will, on shaking the bottle, illuminate a dark chamber. This power of giving light sometimes continues two or three days in succession, but becomes very faint, depending evidently, on the continuance of crystalization, and not on the electricity of friction by agitation.

If the hot solution be suddenly cooled so as to produce a pulverulent mass of the arsenious acid, no light, or at best, a very feeble one, will be seen. The crystalization of sulphate of potash has been most frequently observed to emit light, but always accidentally, and never perhaps in the *pure* sulphate.

Arsenious acid is known to exist in two different isomeric conditions. It is either transparent and vitreous, or porcelainous and opaque. After fusion it is quite transparent, but in time becomes milk white and opaque, without any increase of weight. Both the specific gravity, however, and the solubility in water are different in these two states. In the opaque acid, commonly used as rats bane, no light has been observed by the author, or at best, a very feeble one, on slow cooling.

The cause of the evolution of light in the case now described, is considered by Rose as unknown, and in need of additional facts to render it intelligible. Berzelius remarked the appearance of light during the crystalization of fluoride of sodium, in a liquid which held that salt in solution. Jour. de Pharmacie. Avr.

Decomposition of Sulphates by Oxalic Acid. M. Vogel of Munich, has ascertained that oxalic acid will decompose the sulphates of iron and copper so far as to set free the whole of the sulphuric acid, thus proving that it has a stronger affinity for the oxides of iron and copper, than sulphuric acid has. Its decomposition of gypsum, attributed to its affinity for lime, is well known. It is probable also that oxalic acid effects the complete decomposition of the sulphates, whose bases are the oxides of zinc, manganese, cadmium, &c. The oxalate of the oxide and oxidule of iron is a yellow powder, almost insoluble in water, and which heated to redness in a closed vessel, leaves the protoxide and carburet of iron. The oxalate of copper is a clear blue powder, insoluble in water. Heated to redness it yields metallic copper mixed with the protoxide. Idem.

Spirit of Wood. Damas and Peligot, have lately discovered a very remarkable product which they have named *Spirit of Wood.* It resembles very closely alcohol or spirit of wine. Treated with four times its weight of sulphuric acid it furnishes an ether which has precisely the same composition and density; and with various acids, benzoic, acetic, oxalic, &c. it yields as many different ethers, for which these gentlemen give exact formulæ. Its chemical agencies and properties appear to be quite as certain and well defined as those of alcohol, and it is presumed that ethers may be obtained from it which alcohol does not yield. Spirit of wood, purified, is already on sale, at Lemire's, Rue de la Verrerie, No. 19, Paris. Recuiel Indus. Avril.

Note on the Assay of Gilded Ware by the Wet Process. By H. Bouligny, *Assayer at Evreux.* The art of assaying the precious metals or determining their proportions in alloys, so long stationary, has within a few years made immense progress. M. Gay Lussac, in reducing to form his method of assaying by the wet process, has, if we may so term it, established the limits of this art in relation to silver. This process is nevertheless not generally adopted, notwithstanding its precision and other advantages. The application of this method to the analysis of gilding begins also to spread. It is thus practised: Boil the alloy in a mattrass with nitric acid, and precipitate the silver by the normal solution. The proportion of silver being known, dissolve the chloride of silver in ammonia, and the gold, which is insoluble in that alcali, is recovered in the usual way, and finally weighed.

This process, which is very exact when the alloy contains no tin, appears somewhat complicated to assayers who are not accustomed to chemical manipulations. That which I propose, is founded on the same principles and will appear perhaps of easier execution as it does not require the use of ammonia.

Take a quantity of the alloy containing about 1000 of fine silver, boil it ten minutes in a ground mattrass with 30 grammes of nitric acid at 22°, decant with care into a ground flask of the capacity of about 250 grammes; boil the alloy again five minutes in 15 grammes of nitric acid, at 36°, and decant with equal care this solution into the flask: pour into the mattrass 30 grammes of distilled water to remove all the nitrate and add it to the two former solutions. The flask which contains them is to be stopped and set aside. If any particles of nitrate of silver should adhere to the orifice

of the mattrass they must be carefully removed and added to the solution in the flask.

Fill the mattrass with distilled water, and reverse it in a crucible to collect the gold which must be dried and weighed. This weight is that of the gold contained in the alloy, which must be brought to unity by the rule of proportion. If, for example there were 1114.82 of alloy and 4 mill. of gold have been obtained, the weight of this metal in 1000 would be the fourth term in the proportion $1114.82 : 4 :: 1000 : x$

$$x = \frac{1000 \times 4}{1114.82} = 3.588$$

The flask containing the solution of silver and copper, will be marked as an assay for silver, and the operation will be completed.

If the alloy contain tin, which would be known by the presence of a white powder at the bottom of the mattrass, this process would by no means answer. Recourse must then be had to cupellation and parting.

In terminating this note, I ought to observe, that this process is applicable only to gilding, which contains as a minimum of gold 150 to 1000 of alloy.

Annales de Chim. Nov.

Patent Rotary Printing-Apparatus. A patent has recently been taken out by Mr. Rowland Hill for a Rotary Printing machine. The types are imposed* upon cylinders, to which they are firmly attached, and of which, except the marginal spaces, they occupy the whole surface. The pressure is given by blanket-covered cylinders of the ordinary construction.

The most important advantages of this arrangement are stated to be, first, That as the revolving type cylinder is constantly receiving its ink in one part of its revolution, and constantly impressing the paper in another part, the action of the machine is unceasing; whereby a saving of time of about three parts out of four is obtained in comparison with the ordinary printing machines, when moving at the same velocity; because in those machines the backward motion of the form,* and the laying on of the ink, suspend for the time the process of printing. Further, as the motion of the type in this machine is continuous instead of reciprocating, the speed has been increased without difficulty or danger; and by this additional velocity, combined with the saving of time just described, the rate of printing is brought to about ten times that of the ordinary perfecting machines, i. e. those which print the sheet on both sides before it leaves the machine. Secondly, the reciprocating motion of the heavy form, inking table, and inking rollers of the ordinary machine entails such a loss of power and time, in comparison of the rotary motion which is here substituted for it, that it is believed, from careful observation, that, notwithstanding the great increase in speed, any given quantity of work will be executed at the expense of about one-eighth of the power required in the ordinary machine.

The facilities provided for fixing the type, detaching parts for correction, applying the ink and regulating its supply, are said to be fully equal, if not superior, to those of other machines.

Compared with the rapid machines used for printing the daily newspapers, the rotary machine will print two sheets on *both* sides with accurate register, while they print *one* sheet on one side with defective register.

Lond. Mech. Mag.

Improvements in Steam Carriages on Common Roads. We noticed in the preceding volume of this Magazine, two inventions of M. Galy-Caza-

* These words are used technically.

lat, which were designed for the improvement of steam carriages. We have since learnt, by a communication from the inventor, that they are part only of a series which has for its object the accomplishment of a problem in which so many have failed, and so much capital has been unproductively expended—the construction of a safe steam carriage, for the conveyance of passengers at a desirable velocity on common roads, which shall be perfectly safe from accidents by explosion, &c.

After a long and careful examination of the subject, and many experiments, on a full scale, M. Galy-Cazalat decided, that the following ameliorations were all desirable in the most improved carriages yet known, and most of them necessary; these he conceives he has perfectly accomplished in his steam carriage,

1. An arrangement by which the liability of the axle-tree-crank to break is diminished.

2. A mode of suspension of the engine, &c., which prevents its action from being disturbed by joltage.*

3. An apparatus for guiding the carriage, by means of the steam itself, with great facility.

4. An hydraulic break for diminishing the velocity, and, when desirable, entirely stopping a steam carriage, upon a declivity.

5. A steam-generator, of simple construction and little weight; with a fire place in which coal may be used as a fuel without giving out smoke.

6. An apparatus of great simplicity and of easy application, by which explosions of steam generators and boilers may be, at all times, *prevented*.†

7. An apparatus, also of great simplicity, and incapable of derangement, by which the water surface in steam generators and boilers is constantly maintained during the working of the engine at the same level.‡

It will be evident to all who understand the subject, that supposing M. Galy-Cazalat has succeeded to the extent which he describes, he has removed nearly all the more important impediments which have up to this moment obstructed the progress of this valuable application of steam power.

Mag. Pop. Sc.

Progress of Civil Engineering.

Health of Cities.—Improvement of London.

The immense importance of an ample supply of good water and the free circulation of pure air, to the inhabitants of cities and towns, is now universally acknowledged. During the prevalence of an epidemic, it is almost the dictate of *instinctive* wisdom to flee from the infected region, and seek for safety in places where the air and the water are uncontaminated. The preservation of the public health is the absolute duty of those who have the control of public affairs; and nothing within the range of this duty is of more vital consequence than to guard the purity of those elements that feed the flame of life in every human bosom, and regulate the functions which render the food we eat either nutritious or injurious.

* Examined and approved by the Institute of France, and rewarded with their gold medal, in 1833.

† Examined, tested, and approved by *La Sociétié d'Encouragement* of Paris, and rewarded with their large gold medal, in December, 1835. Described in p. 395 of the preceding volume of this Magazine.

‡ Described p. 397, as above.

To the improvements that have resulted from the progress of knowledge in the modes of eating, drinking, breathing and clothing, may be ascribed that remarkably increased longevity which is evident in many of those cities and countries where civilization and science are in the highest stages of advancement. Our American cities are increasing with a rapidity almost unknown, and, there is much reason to fear, without a due regard to the safety, health and comfort of their future inhabitants. That our climate is not, in general, so favourable to sound, robust health, as that of Europe, no one who has carefully observed the appearance and manners of the great mass of the population in both quarters will be disposed to deny. And yet, whoever compares the maps of the thickly settled, and regulated portions of our principal towns with those of European cities, will be struck with the far greater *paucity of open space* presented by the former.

The modern parts of London have been laid out with a most judicious regard to *good breathing*; but the supply of that great metropolis with good water, is still a desideratum which occasions much anxiety to all who are led by science and humanity to engage in schemes of improvement.

The river is still the chief source of supply, and whoever reflects upon the amount of feculent matter which must pass into that stream from a million and a half of inhabitants, will be prepared to admit the difficulty in devising any mode of effectual depuration.

"If the Thames water, (according to Dr. Bostock, who communicated the result of his interesting inquiry to the Royal Society in 1829,) be suffered to remain at rest, completely undisturbed, for a period of many weeks, fermentation will take place, in consequence of the presence of the softer portions of human ordures; the liquid will become clear, with the exception of a small portion of insoluble sediment; it will lose all unpleasant smell, taste, and colour; and present, instead of animal impurities in solution, an increase of its ordinary saline contents. This increase is to the extent of between two and three times, with regard to chalk, or carbonate of lime; of between five and six times, with regard to gypsum, or sulphate of lime; and of twelve times the usual quantity, with regard to common salt, or muriate of soda. By this change in the relative proportions of its saline contents, the water ceases to be soft, and becomes hard, inasmuch as each pint of it is found to contain four grains and $\frac{36}{100}$ of saline matter. Supposing, therefore, that the companies were to establish reservoirs of such magnitude as to allow the water to be lodged undisturbed therein, during a period of time sufficiently long for the depurative process by spontaneous fermentation to take place, which is to destroy all animal impurities in it, they would still supply the public with what, although clear and inodorous, would contain enough of chalk and plaster of paris to multiply, and render more severe, the various and innumerable degrees of derangements of the stomach and bowels, which so generally prevail in, and are almost peculiar to, this metropolis."*

No process of filtration, whatever may be the materials employed in clarifying, can deprive water of the ingredients that are chemically dissolved in it. "Would any one, knowingly, and with cheerfulness, drink a tumbler of water from a river spring, which should have previously run through a succession of cess-pools, and afterwards been filtered through sand and gravel, because it may then appear clear and transparent? Yet such is the case with

* Architec. Mag., Aug. 1836.

those, collectively, who drink, in some way or other, the Thames water of the London district!"*

The report of a committee "appointed at a general meeting held at the Right Hon. the Earl of Euston's, M. P., in Grosvenor Place, on the 3d of March, 1836, for the purpose of taking into consideration Mr. Martin's plan for rescuing the Thames river from every species of pollution; for the improvement of the wharfage, the establishment of two great public walks, and for other objects of public utility and importance," has the following suggestions.

"What, then, are the conclusions to be derived from the various parts of the present statement in reference to the supply of water in London? They are as follows:—

"*First*, That the water of the Thames, in front of London, is *always* in a most intense state of pollution.

"*Secondly*, That the process hitherto adopted for purifying it (subsidence) has proved insufficient, and leaves the most objectionable impurities still behind in the water.

"*Thirdly*, That even a more effectual process (fermentation, supposing it to be adopted, notwithstanding the great waste of time and money which it would entail) would only substitute one evil for another, as far as the health of the consumers is concerned.

Fourthly, That the most perfect, even, of all the processes of purification (filtration,) were it practicable, would not free such polluted water as that which we derive from the river (where it passes through London) from all its disgusting and injurious properties.

"And that, therefore, the only real remedy is to adopt the plan which turns away from the river the numerous streams of impurities that flow into it at present. And that the evil to be thus remedied is one fully, experimentally, and mathematically demonstrated; one which is of most serious injury to the health of a million and a half of the King's subjects; one, in fine, to which the public authorities cannot much longer refuse their most earnest attention."†

"It was given (says the Report) to the genius of Mr. J. Martin to devise the simplest, as well as the most completely effectual, plan for affording, at once, all that the public require, without injury to the rights and interests of the water companies, or interference with them; but, on the contrary, with manifest benefit to them, by saving any further outlay of capital, which they might think themselves called upon to employ in fruitless endeavours to satisfy public opinion. This plan may be defined in a single sentence; it consists in diverting, altogether, from the river every possible source of pollution within the London district; so that the water supplied from it to the inhabitants by the existing water companies shall become as unobjectionable as a noble river in its natural state ever offered to man; for, according to Dr. Bostock's evidence, given before the royal commissioners in 1828, The water of the Thames, when free from extraneous substances, is in a state of considerable purity, containing only a moderate quantity of saline contents, and those of a kind which cannot be supposed to render it unfit for domestic purposes, or to be injurious to health."

"*The manner in which Mr. Martin proposes to accomplish this object is by the construction of a close Sewer*, 20 *feet wide, and of adequate depth*,

* Arch. Mag. Aug. 1836.

† Ib.

along both banks of the river, commencing on the north near Milbank, and proceeding towards the Tower, round which it will pass, if required, to terminate near the Regent's Canal; while that on the south, beginning at Vauxhall, and proceeding in the direction of Rotherhithe, is intended to diverge thence, and terminate near the Surrey Canal. In order to dispose of the polluting drainage thus diverted from the river stream, and confined within these two sewers running parallel to the river, and with somewhat more than the declivity of its bed, Mr. Martin places two great receptacles at their respective terminations, so arranged and constructed, that the accumulation of all the drainage of the metropolis shall not be productive of the smallest annoyance or insalubrity to the nearest inhabitants. With this view, a system of ventilation will be established, both for the great sewers and the receptacles, which will prove equally simple and effectual, whether the committee adopt the one proposed by Mr. Martin himself, who has acquired much knowledge on this point, from having studied the ventilation of coal mines, or apply another, suggested by one of their members, equally competent for the task. In either case, however, the destruction of all noxious effluvia will be accomplished; a consummation which, coupled with the prevention (effected by the great parallel sewers) of the hitherto frequent inroads of the tide into the lower ends of the common sewers, and the consequent backing of the drainage in them, together with other measures for excluding all offensive smells through the street gullies, will render the London drainage more perfect, and the labours of the Commissioners of Sewers less difficult."

"*Erection of two lines of colonnaded Wharfs.*—Great and important as the first object unquestionably is, which Mr. Martin's plan is destined to accomplish, it is not the only benefit which the metropolis will derive from its being carried into effect. Although it seldom happens that, in adapting any very extensive remedy to a public grievance, or in undertaking a work of magnitude for the good of the people, local and individual interests are not in some degree injured or invaded, Mr. Martin's plan has the additional merit of being little exposed to such an objection. On the contrary, his plan, by the next object which it embraces, and which is, as it were, its natural consequence, is calculated to add to the value of most of the individual interests affected by the line of its operations. That object is the erection over the two sewers of a line of colonnaded wharfs, which will afford in front of the present wharfs additional room; increase the convenience of the merchant and the labourer; facilitate the operations of trade; give greater security to property landed from vessels and barges; improve the navigation of the river by the assistance of the subjacent sewers, which will constitute uniform embankments; and, lastly, add some portion of time to the number of hours during which the craft can deliver or take in their cargoes. The immense, and recent, advances which mechanical science has made in this country will enable the architect and engineer employed in the construction of these wharfs to take advantage of their uniform arrangement, and apply, through the engines required for the ventilation of the two great sewers and receptacles, either to the entire range of wharfs, or to any part of it where it may be required; the power obtained from atmospheric pressure acting on a vacuum, which has been so successfully applied, of late years, to cranes and other machines, and which, in this case, it is presumed, would be gladly adopted by the proprietors of storehouses, manufactories and breweries situated on the banks of the river, whereby another great advantage to those proprietors would be obtained from Mr. Martin's plan.

Respecting this useful application of mechanical science, the committee have the satisfaction of being able to refer to the opinion of one of their members, who is perfectly acquainted with the subject."

"*Formation of two extensive Quays, or Public Walks.*—But even this great metropolitan advantage, secured by Mr. Martin's plan, must yield the palm to another of a more popular and attractive nature, arising out of the accomplishment of a third object contemplated, also, by Mr. Martin. The committee, therefore, feel particular satisfaction in having further to report, that the same plan offers the most favourable opportunity of establishing, at a comparatively small expense, a magnificent promenade on each side of the river, unequalled in Europe, by the conversion of the roofs of the colonnaded wharfs, just described, into parapeted walks, to which the public will be admitted gratuitously on Sundays, and at the smallest rate of charge on every other day in the week. It is thus that the patriotic idea of Sir Frederick Trench will be realised, in respect to the erection of quays on the banks of the Thames, without the liability to the several objections which powerful individuals and public bodies made to the purely ornamental and architectural project of that gallant officer, who, with high-minded liberality, has declared Mr. Martin's plan to comprise more than his own, to be greatly superior in usefulness, to the public, and to deserve his utmost support. It is thus, also, that the wishes, so often expressed of late, by Parliamentary committees, of affording to the mass of the population, the luxury, salubriousness, and recreation of great public walks, in the very heart of London, will be accomplished at once, and on a more extensive scale than has ever before been contemplated."

"*Magnificent Architectural Promenade.*—It would be superfluous, on the part of the committee, to undertake to prove, that the establishment of a grand and magnificent public walk on each bank of the river, and behind a most crowded line of habitations running east and west of the metropolis, must be of infinite service to the neighbouring inhabitants, by affording them an opportunity of taking exercise in a reserved public walk (well calculated, too, for women and children,) and of enjoying a free and open atmosphere during the days and hours not devoted to labour, besides the benefit of a more direct intercourse. To these advantages they are certainly strangers at present, owing to their remote position from the parks, and from every other general resort of pedestrians; and, although a select committee of the House of Commons did recommend, in 1833, an extension and improvement of the embankment along the river from Limehouse to Blackwall, at a considerable expense to the parishes within that district, so partial a measure could only be useful to those whose residence is contiguous to the walk, without being of service to the inhabitants of the more central parts of the metropolis along the north bank of the river, where it is most required. On this point the committee have obtained the opinion of one of their body, who is a medical man, and who, having practised for the space of twenty years as physician to three extensive public institutions in London, principally connected with the relief of the sick poor of the river districts, has had numerous opportunities of ascertaining the effect of the impure water of the river, of the confined air of the streets and alleys adjoining to it, and of the want of exercise, on the general mass of the inhabitants of those districts. The committee specially refer to that opinion, in addition to that of the witnesses examined before the Parliamentary committee of 1833, principally because, in a question so entirely belonging to the consideration of public health, the long experience of a medical witness is more likely to carry weight with

those who have the protection of that health in their keeping. The want of means to take proper walking exercise, after a long day of laborious exertion, impairs the vigour of the body, produces among the working classes a morose and melancholy disposition, and engenders a spirit of dissatisfaction, which domestic privations are too apt to increase. Such feelings, in their turn, hurry their victims on to the resorts of the drunkard and the abandoned; where, if they imbibe not the spirit of discontent, they most assuredly sap the very foundation of their own health, and that of their future offspring. The committee, fully coinciding, also, in the sentiments expressed in the report of the select parliamentary committee, just alluded to, on public walks, refer with particular pleasure to the part of that report where the peculiar natural advantages which the metropolis might possess in respect to public walks on the banks of the Thames, are especially recommended to the consideration of the House of Commons."

"*Protection of Property.*—There is one more public benefit, which the establishment of a great walk on each bank of the Thames is calculated to secure, and which, hitherto, has not only remained unaccomplished, but has even escaped notice, namely, the protection of property on the river by night. It is a well-known fact, that, taking advantage of the many hundred craft which are left at night without a watch, and of the darkness, which conceals evil deeds, youthful thieves, and others, commit considerable depredations on the river. The brilliant illumination by gas of the great walks, and, if necessary, of the wharfs too, may be expected to put a salutary check to such guilty practices, and diminish the serious losses consequent thereupon; while the facility which the same walks will afford to the Thames patrol, of overlooking every movement on the river, will complete this, not insignificant, advantage to the public."

"*Formation of Public Baths.*—Connected, also, with the establishment of the great quays in Mr. Martin's plan, it will be found that an opportunity is afforded for the formation of large public baths, contiguous to the river, and so arranged that they shall not in the least interfere with the purity of the river stream. Respecting the necessity and utility of public baths, as far as regards the health and cleanliness of the working classes in London, it is scarcely necessary to cite any authority. Upon that important subject, however, as well as on the general effect which the extensive improvements and total changes effected, in the state of the river and its banks, by Mr. Martin's plan, will have in greatly promoting the salubrity of the populous districts near the Thames, the committee refer, with confidence, to the experience of the same individual whose opinion on public walks they have received, and who derives that experience from repeated observations made in London, and in all the principal capitals of Europe, constituting a valuable corroboration of the testimony of well-qualified witnesses given before the select committee on that subject."

"*Preservation and Application of Manure.*—The drainage received into the great receptacles, before mentioned, will be converted into manure, according to the method and practice very extensively adopted in China, on the continent of Europe, and of late years, also, in some parts of Scotland. This will be conveyed by well-devised arrangements, and under the influence of scientific measures, to different parts of the country, in covered barges, or properly constructed land-carriages. The value of this species of manure is almost incalculable. The best authorities place it far above every other, as containing in much greater abundance the very elements of which vegetable substances are composed, and on which their existence and growth

depend. By saving, therefore, the vast quantity of it which has hitherto been wasted in the metropolis, a *fourth*, and most important, benefit, that of fertilising, and rendering the land considerably more productive, will be conferred on the public, through the identical plan, which alone can secure to us the luxury of drinking wholesome and unpolluted water."

"*Financial Statement.*—On the financial part of a plan so simple, yet so gigantic in its results, a plan, too, which seems encompassed by fewer difficulties requiring pecuniary sacrifices, than are generally met with in great public schemes, the committee do not think it necessary to dilate at length. They have, however," produced an estimate (signed, *R. Dixon, Fellow of the Institute of British Architects*) by which the expenses of construction are upwards of £1,000,000 sterling; and another of income and expenditure, by which, after paying a dividend of 8 per cent., there appears a surplus balance of £206,000."

"The principal source of income is the manure, for which it is calculated to produce £200,000."

The report is dated London, April 23, 1836.*

"*Mode of ventilating the Receptacles and Sewers generally, and of destroying all noxious Effluvia from them. (Proposed by* N. Ogle, Esq.)—Anxiety will naturally be felt respecting the method by which the exhalations from so large a collection of animal and other impurities, amounting, at a moderate computation, to several millions of pounds, are to be rendered imperceptible to the senses, and innoxious to health. With a view of removing all such feelings, I submit the following explanation of this very essential part of Mr. Martin's plan:—

"Over the great receptacles fires will be placed, so arranged that no air shall reach them but that which has been drawn through all the ramifications of the sewers which intersect the ground beneath the streets. Thus a constant in-draft of atmospheric air will be drawn down into the great sewers, which will prevent the effluvia, now too commonly perceptible during particular states of the weather, from rising into the houses or roads. As the heat from these fires will be used to generate steam to work, by engines, the pumps which are to be employed for the double purpose of removing the manure from the receptacles, and of producing a vacuum in the hollow columns and architraves, by which atmospheric pressure may be used as a constant power at every warehouse, wharf, and manufactory; the establishment of such fires will afford three direct advantages. But, besides these, another important result will be obtained from them; for, by blowing the waste steam, which has passed the engines, into the lofty chimney placed over the receptacles, another vacuum will be created, which will draw up through the fires, with vast rapidity, the air commingled with the sulphuretted, and carburetted hydrogen, the carbonic acid gases, and whatever else may be evolved from the fermenting mass. In order to keep those gases always in motion, the atmospheric air extracted from the hollow columns and architraves, as before stated, will be ejected with force into the great receptacles, thence to be drawn through the fires by the action of the above chimney. By this process all effluvia will be destroyed."†

"*The Institute of British Architects' Letter to John Martin, Esq., dated 43 King Street, Covent Garden, 3d March, 1836.*—My dear Sir,—As you were yourself present at the last ordinary meeting of the Institute, held on Monday, the 29th of February, you are fully aware

* Arch. Mag. Aug. 1836.

† Ibid.

of the intense interest with which the members received the description of your admirable project for improving the discharge of the sewage of this metropolis, and relieving the Thames from those impurities which now so materially injure its waters, and affect the health of the inhabitants. I am, however, directed by a special resolution passed on that occasion, to present to you the thanks of the Institute for having submitted this important subject to their notice. Perhaps this acknowledgment may not be considered by you the less valuable, as proceeding from a body of professional men, whose practical experience enables them, even from so brief a view of the subject, to appreciate, in a general way, the important results which might arise from the adoption of a plan of such a nature. I am, my dear Sir, with every expression of sincere regard, yours very faithfully and truly,—*Thomas L. Donaldson, Honorary Secretary and Corresponding Member of the Institute of France.*"*

In a future number we may present the objections to the plan of Mr. Martin, which appear in the Architectural Magazine of London, with other suggestions for the improvement of the metropolis.

Mechanics' Register.

Coins and Medals. In a lecture lately delivered before the Society of Arts, Mr. Wyon described our present mode of engraving and multiplying the dies.

The selection of the best cast-steel for the purpose, he observed, was very important, and not sufficiently understood at present. The very fine steel that forms excellent gravers, and other cutting instruments, is unfit for the purpose, for unless hardened with great care, it is very liable to crack. The very coarse steel is also objectionable, as it acquires fissures under the die press. The object therefore is, to select steel of a medium quality—but the best steel may be spoiled, by want of skill in the smith who forges the dies.

When the rough die is brought to a table in the turning lathe, after being softened, the engraver commences his labours, by working out the device with the small tools in intaglio (sunk in), and when he has completed his work, the die is ready for hardening, which is, in itself, a very simple process—but one that is often attended with serious disappointment to the engraver, for it not unfrequently happens, that the labour of many months is either injured or utterly destroyed, from the steel itself being faulty or heated to excess. But supposing the original die, or as it is technically called, a matrix, to be uninjured by the process of hardening, it is reserved for the purpose of furnishing a puncheon (or a steel impression in relief.) For this purpose, a block of soft steel is turned flat at the bottom and obtusely conical at the top. In this state, its conical surface is compressed into the matrix by a blow from the multiplying die press: this gives us only the commencement of an impression, for the die becomes so hard by compression, as to require frequent annealing and re-striking before it is perfected. An impression taken in this way is called a puncheon, which, when the engraver has given it all the delicacy of finish existing in the original, is then hardened, and serves for the purpose of making dies for coining, by a similar process, viz., impressing the hardened steel into that which is soft.

* Arch. Mag. Aug. 1836.

The distinction, said Mr. Wyon, between striking medals and coins, is very essential, so much so, that I cannot avoid saying a few words on the subject. A medal is usually engraved in high relief, like those upon ancient coins, and it requires a succession of blows, sometimes forty or fifty, with repeated annealings, to make a perfect impression. A modern coin, on the contrary, is usually brought up with one blow, although with the disadvantage of the metal being harder. Standard gold, for instance, consists of one-twelfth of alloy: medals are usually made of fine gold; the engraving upon the coin is consequently made with a suitable degree of relief.

In striking a coin or a medal, the lateral spread of the metal, which would otherwise ooze out, as it were, from between the dies, is prevented by the application of a steel collar, accurately turned to the dimensions of the dies. The number of pieces which may be struck by one pair of dies, not unfrequently amounts to between three and four hundred thousand, but the average amount is much less. Mr. Wyon stated, that he remembered instances of twenty dies being destroyed in one day, owing to the different qualities of steel, and to the casualties to which dies are liable. There are, it appears, eight presses in the coining-room of the Mint, and he considers that the destruction of one pair of dies for each press per day, is a very fair proportion, though it is generally rather more.

It must be remembered, that each press produces sixty pieces per minute, without reckoning stoppages occasioned by changing of dies and other contingencies; and Mr. Wyon remarked, that in 1817, the daily produce of coins, in half-crowns, shillings, and sixpences, amounted to the enormous quantity of 343,000 per day, for three months: at that time all the eight presses were employed; but, on the 1st of last April, there were 125,000 pieces coined with five presses only. From the 4th of June, 1817, to the 31st of December, 1833, there were coined in sovereigns and half-sovereigns, 52,187,265*l.* sterling. Arcana of Science, 1835.

Great Blast at Craigleith Quarry. The long time in which preparations for a great explosion at this quarry had been going on, and the effects that were expected to result from the experiment, by a great saving of labour and expense, in at once dislodging a great mass of rock, and also lessening, if not altogether removing, the risk which attends the blowing up of small portions of rock from the flying fragments, rendered the experiment which took place on Saturday the 18th of October, 1834, a subject of much interest both in a public and scientific point of view. It having been intimated by bills that the blast was to take place at three o'clock, long before that hour crowds of people were proceeding along the roads leading to the quarry, and by three o'clock every place which commanded a view of the spot was filled with spectators. At the time when the explosion took place, there were no fewer than ten thousand persons on the grounds around the quarry; and curiosity was so much excited, that even the Castle-hill, and also on the Carstorphine-hill, a great many people were collected. At half past two o'clock, the conductor, inclosed in a block-tin tube twenty-six feet long and half an inch in diameter, was introduced into the bore. The depth of the bore was sixty feet, and seven and a half inches in diameter at the top, and six at the bottom, and was charged with 500 lbs. of Sir Henry Bridge's double-strong blasting powder. At half past three the match was lighted, and in three minutes the explosion took place. The report was not so loud as from a small piece of ordnance; but the effect

that was produced was highly satisfactory to all the scientific gentlemen present, and completely fulfilled the expectations that had been conceived by the projector. At the moment of the explosion, the great mass of rock appeared to those at a short distance to be forced upwards, and then to rend in large and deep fissures. It is calculated that upwards of 20,000 tons of solid rock have been displaced by this experiment. Ibid.

To prevent Ink becoming Mouldy. Add to each pint bottle of common writing-ink five drops of *kreosote:* it gives the ink a slight odour of smoked meat, which is by no means disagreeable, and effectively obviates its tendency to become musty. The same preventive applies with equal efficacy to Stephen's blue writing fluid.

Kreosote is a liquid extracted, by a circuitous process, from wood-tar, and may be purchased at the chemists' shops. Lond. Mag. Pop. Sc.

Stereotype plates of Iron. Mr. Zeigler, a printer of Blankenburg, in Brunswick, has printed a bible from iron stereotype-plates. The advantages of using this material for such a purpose are not stated. Ibid.

Ploughing by Steam. Some experiments have been tried at Red Moss, near Bolton, Lancashire, in the presence of Mr. Handley, M. P. for Lincolnshire, Mr. Chapman, M. P. for Westmeath, Mr. Smith, of Deanston, and other gentlemen interested in agriculture, with a new and very powerful steam plough, constructed by Mr. Heathcote, M. P. for Tiverton, About six acres of raw moss was turned up in the most extraordinary style; sods eighteen inches in breadth and nine inches in thickness being cut from the furrow, and completely reversed in position, the upper surface being placed exactly where the lower surface had been before. The possibility of ploughing by steam has thus been established, though the machine appears much too complex and costly for common purposes. Mining Journal.

Results of Machinery. Rapid as the increase of buildings in and about London has been, it is quite outdone by similar operations in Manchester, which is said to contain 700 streets more than it did four years ago. Ibid.

Ingenious piece of Mechanism. A very ingenious piece of mechanism, a miniature steam engine, has been constructed by Mr. Richard Corfield, a young man in the employment of Messrs. Gittins and Cartwright, at the Eagle Foundry, Shrewsbury. It consists of an engine not exceeding an half-inch cylinder, for the purpose of propelling a small steamboat, working its propelling shaft at the enormous speed of five hundred and fifty revolutions per minute—travelling a distance of thirty miles in one hour. The boiler is so constructed as to admit a spirit-lamp in the centre of the water, which affords sufficient fuel and steam for one hour. We should add, that the above is one of many extraordinary specimens of useful, though miniature and elaborate, works of art, made by Mr. Corfield. Ibid.

To hasten the flowering of bulbous Plants. Fill a flower pot about half full of quick lime, and over this put good mould, and in it plant the bulbs. Keep the earth always slightly moist, and press it down as it rises by the swelling of the lime. The flowers may thus be obtained in a very short time and at all seasons. Jour. Conn. Usuelles, Mars.

To deprive Icelandic moss of its bitterness. Steep it twenty-four hours in

an alkaline solution, then leave it a few hours in fresh water and the bitterness will be removed. Lye from wood ashes is very suitable. Ibid.

Improvement of Coffee. Many things have been proposed as substitutes for Coffee. Rye, and other grain, beans, peas, chicory, beets dried, &c. have in turn been proposed and their qualities valued. For some years past there has been sold in Paris, under the pompous name of *Coffee flowers imported from America*, a dark powder, a pinch of which really communicates to coffee a very agreeable aroma and allows of a little diminution of the quantity. I have examined this powder, and find it to be only sugar caromelized, or rather, almost completely chared. A small quantity of caromel produces precisely the same effect.

Chesnuts deprived of the envelope, cut into fragments of the size of coffee grains, dried and mixed with real coffee, roasted and ground together, are the best substitutes I have found. I have used it for thirty years. Some mix them in equal proportions. Bodin De La Pichonnerie. Ibid.

Preservation of Aliments. At a meeting of the Society for the Encouragement of National Industry in France, held March 16, 1836, Count de Lasteyrie announced the presence of Captain Ross, the celebrated navigator, and M. Jomard presented from him a tin box, containing preserved meat which he had brought from Cape Ferry, Lat. 72° 47′ N. and 90° Long. west of Greenwich, where it had been deposited by Capt. Parry, in August, 1824. The box was prepared by Gamble and Donkin, London, about 1820. This box, after passing through the West Indies, had been exposed to the Arctic regions eight years, being brought back in 1832.

Bull. d'Encour. Mars. 1836.

List of American Patents which issued in July, 1836.

		July.
513.	*Plough.*—Timothy Miller, Pittsburgh, Penn.	2
514.	*Fractured thigh apparatus.*—Samuel Woolston, Vincentown, N. J.	2
515.	*Plough.*—Isaac Snider, Mount Pleasant, Penn.	2
516.	*Hydrant.*—Sater T. Walker, Baltimore, Md.	2
517.	*Clover machine.*—William Loomis, Ashford, Conn.	2
518.	*Ice breaker.*—Michael Freytag, Philadelphia,	2
519.	*Anchor, cast-iron.*—James S. Stoddard, Palmyra, N. Y.	2
520.	*Cooking stove.*—Chester Granger, Pottsford, Vermont,	2
521.	*Rotary steam engine.*—Franklin Carpenter, Casenova, N. Y.	2
522.	*Staves for barrels.*—Cyrus McGregory, Newport, N. H.	2
523.	*Brick moulding machine.*—James Coppuck, Louisville, Ky.	1
524.	*Raising water by weights.*—David Hess, Shepherdstown, Va.	1
525.	*Sheaves for blocks.*—Cyrus Alger, Boston, Mass.	1
526.	*Cooking stoves.*—Asael Lear, Wendell, N. H.	1
527.	*Washing machine.*—William Newton, Warren county, Ohio,	1
528.	*Generating steam, &c.*—Isaiah Jennings, N. Y.	1
529.	*Combs of metal.*—R. A. Ives, Bristol, Conn.	1
530.	*Cleaning rags.*—George Carriel, Manchester, Conn.	1
531.	*Clocks.*—Joseph Ives, Bristol, Conn.	1
532.	*Hydrant.*—Sater T. Walker, Baltimore, Md.	1
533.	*Sowing grain.*—William C. Greenleaf, Andover, Maine,	1
534.	*Water wheels.*—Charles Kenzie, Troy, N. Y.	1
535.	*Road making.*—John S. Williams, Fulton, Ohio.	1
536.	*Churn.*—Davis Variel, Minot, Maine.	1
537.	*Mill stone dresser.*—John Tusk, Columbus, Penn.	1
538.	*Cutting straw.*—Mallory M. Marshall, Smithfield, Va.	1

		July.
539.	*Traveling trunks.*—Washington Sweetzer, Portsmouth, N. H.	1
540.	*Spirits of turpentine, extracting.*—Isaiah Jennings, N. Y.	1
541.	*Saddle.*—Otho W. S. Callahan, Staunton, Va.	1
542.	*Shingle machine.*—Tunis T. Burhyte, Barton, N. Y.	1
543.	*Woolen Yarn.*—William B. Walker, Hillsborough Bridge, N. H.	1
544.	*Trunks, valisses, &c.*—William Brown, Brooklyn, N. Y.	1
545.	*Rotary saw.*—Robt. S. Thomas, Rockingham, N. C.	1
546.	*Frieze window, &c.*—William Wooley, N. Y.	1
547.	*Locks for doors, &c.*—Almon Roff, N. Y.	1
548.	*Mill for grain, &c.*—Oliver Wyman, Watertown, Mass.	1
549.	*Andiron bars.*—James Cochran, Batavia, N. Y.	1
550.	*Tailoring, art of.*—James Wesler, Jr. Hagerstown, Md.	1
551.	*Mattresses, bolsters, &c.*—A. Salisbury, and J. Uram, Troy, N. Y.	1
552.	*Cooking stoves.*—E. Andrews and S. Austin, Bradford, N. H.	1
553.	*Distilling.*—A. R. Ken and H. Hoover, Waynesborough, Penn.	1
554.	*Saws, straining.*—E. Rathburn and W. Tinker, Conneaut, Ohio,	1
555.	*Force pump, double.*—John G. White, Dryden, N. Y.	1
556.	*Truss for hernia.*—Isaac Thompson, Brattleborough, Vt.	1
557.	*Cooking stove.*—Elish N. Pratt, Albany, N. Y.	1
558.	*Mowing machine.*—William Greenleaf, Andover, Maine,	1
559.	*Spark extinguisher.*—Gabriel Winton, Donaldsonville, Louisiana,	1
560.	*Plough.*—John M. Tilford, Murfreesborough, Tenn.	1
561.	*Awl haft.*—William Campbell, Gilsum, N. H.	1
562.	*Saddles, ladies'.*—William Jenkins, Ithaca, N. Y.	1
563.	*Fire place.*—Reuben Buck, Acton, Maine,	1
564.	*Chimneys, ovens, &c.*—Elisha Smith, Ithaca, N. Y.	1
565.	*Foot stove.*—Ezekiel Duball, Canaan, Conn.	1
566.	*Gun and pistol lock.*—Johnson Marsh, East Dorset, Vt.	1
567.	*Water wheel.*—Samuel Garrett, Londonville, Ohio.	2
568.	*Fires, extinguishing.*—Isaac Clowes, Norfolk, Va.	2
569.	*Brick machine.*—Calvan Waterman, Bath, Maine.	2
570.	*Locomotives and rail roads.*—Isaac W. Edgar, Wayne co. Ohio.	2
571.	*Bolts and spikes, drawing.*—Richard Haynes, Portsmouth, Va.	2
572.	*Gimblets, forging.*—De Grasse Fowler, Wallingford, Conn.	2
573.	*Ventilating stoves.*—Clement Woodward, Washington, D. C.	2
574.	*Saw mill.*—Samuel Goudy, Greensburg, Ken.	2
575.	*Grates, pendulum.*—Nathan Winslow, Portland, Maine.	2
576.	*Cooking stove.*—Philip C. Traver, West Troy, N. Y.	2
577.	*Heating rooms and ovens.*—John A. Pitts, Winthrop, Maine.	2
578.	*Feather dresser.*—T. P. Knowlton, Clermont, N. H.	2
579.	*Stoves.*—Howell Porlalee, Watervliet, N. Y.	2
580.	*Sewers of hydraulic cement.*—Obadiah Parker, N. Y.	2
581.	*Platform balance.*—John Horton, Madrid, N. Y.	2
582.	*Trashing machine.*—Aaron Parsons, Rockfield, Maine.	2
583.	*Vessels, construction of.*—Daniel Gerrish, Boston, Mass.	2
584.	*Lock for doors, &c.*—James McClory, N. Y.	2
585.	*Lever press.*—G. Guyon, N. Y.	2
586.	*Cooking stove.*—Elisha Lyman, Easthampton, Mass.	2
587.	*Horse power.*—Charles G. Gilbert, Leeds, Maine,	2
588.	*Water wheel.*—William F. Brown, Augusta, Maine.	2
589.	*Cotton gin.*—James McCreight, Winnsborough, S. C.	2
590.	*Smut machine.*—Rufus Dennison, Wilton, Maine.	2
591.	*Washing machine.*—James H. Littel, Skeneatelas, N. Y.	2
592.	*Ship thimbles.*—Prentiss White, Yarmouth, Mass.	2
593.	*Fly net for horses.*—Henry Korn, Philadelphia.	2
594.	*Wool and flax comber.*—William W. Calvert, Lowell, Mass.	2
595.	*Hat bodies, stiffening.*—Edward P. Spear, Lexington, Mass.	2
596.	*Smut machine.*—Jonas Pratt, Otsego, N. Y.	2
597.	*Neck stocks, shaping.*—Thomas Goodman, N. Y.	2
598.	*Marsh drainer.*—Jean Blanc, New Orleans, Louisiana.	2

CELESTIAL PHENOMENA, FOR DECEMBER, 1836.

Calculated by S. C. Walker.

Day.	H'r.	Min.					
24	16	57	Im	λ Cancri	,6,	N. 12°	V.69°
24	17	40	Em			300	358

Meteorological Observations for August, 1836.

Moon.	Therm.		Barometer.		Wind.		Water fallen in rain.	State of the weather, and Remarks.
Days	Sun rise.	2 P.M	Sun rise.	2 P.M	Direction.	Force.	Inches.	
☽ 1	69°	80°	29.70	29.70	SW.	Moderate	.8	Cloudy—shower.
2	66	79	30.00	30.00	SW.	do.		Cloudy—flying clouds.
3	64	74	30.00	29.9	SE.	Brisk.		Cloudy—rain flying clouds.
4	68	74	29.80	29.80	W.	Moderate.	.29	Clear.
5	64	77	30.00	30.10	NE.	do.		do.
6	60	69	30.10	30.10		Brisk.		Lightly cloudy—clear.
7	63	70	30.00	29.95	E.	Moderate.	1.00	Rain—Cloudy.
8	64	69	30.00	29.95	SE.	do.		Cloudy—lightly cloudy.
9	70	68	29.80	29.90	W.	do.	.15	Cloudy—clear—shower.
10	55	70	29.95	29.95	NE.	do.		Clear—floating clouds.
11	60	67	29.90	29.85	SW.	do.		Lightly cloudy, do
12	56	72	29.85	29.90	E.	do.	.10	Cloudy—rain.
⊗ 13	69	80	29.90	29.90	E.	do.		Clear, do.
14	66	79	29.75	29.75	SW.	do.		Cloudy—clear.
15	64	70	29.85	29.90	NW.	do.		Cloudy—clear.
16	61	72	29.90	29.90	SW.	do.	.11	Cloudy, do.
17	63	73	29.95	29.95	W.	do.		Clear, do shower,
18	68	76	29.90	29.90	S.	Brisk.	.90	Clear—lightly cloudy.
19	68	82	29.70	29.70	W.	do.		Clear—flying clouds, rain in night
20	66	71	29.90	29.95	W.	do.		Partially cloudy—clear.
21	52	73	29.96	29.96	SW.	Moderate.		Clear day.
☾ 22	62	74	29.9	29.9	W.	do.		Cloudy—clear
23	56	65	30.00	30.00	NNE.	do.	.5	Lightly cloudy—do—rain.
24	59	70	30.00	30.0	NE.SE.	do.		Cloudy—partially cloudy,
25	64	70	30.10	30.10	S.W.	do.		Cloudy—flying clouds.
26	62	69	30.00	29.90	S.	do.	.17	Cloudy—rain.
27	64	76	29.80	29.90	NE.	Calm.		Cloudy—clear.
28	63	80	29.87	29.90	NW.W.	do.		Clear day.
29	66	74	29.90	29.85	SW.	Moderate.		Fog—cloudy—rain.
30	62	69	29.70	29.70	NW.	Brisk.	.5	Clear do.
31	51	72	29.90	29.90	W.	do.		Clear do.
Mean	62.52	73.48	29.91	29.91			1.25	

	Thermometer.	Barometer.
Maximum height during the month	86, on 1st.	30.10 on 5th, 6th, 25th,
Minimum do.	51. on 31st.	29.70 on 1st, 19th. & 30th.
Mean do.	67.97.	29.91.